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Immediate Strengthening of Crude and Refined Oil Markets Expected as Result of Meeting

By ANDREW M. ROWLEY

STABILIZATION of the petroleum industry moved swiftly towards achievement on Wednesday when recommendations of the Washington Conference, adopted unanimously, were presented to President Roosevelt with indications the usual quick action of the administration could be expected. Closing in the flush fields of the five principal producing states would provide immediate relief from overproduction and give the administration and the different states the necessary time to put into effect their plans for re-establishment of the petroleum industry on a normal business basis.

Federal aid and influence in combating the production of hot oil and the evasion of gasoline taxes will exert a tremendous effect upon these evils which have been responsible for the chaotic condition of the industry. And the appointment of a Federal supervisor, or advisor, will eliminate from the picture much of the petty politics which prevented enforcement of proration regulations. The conference also paved the way for solution of other problems affecting the industry.

Even while the conference was in session in Washington conditions rapidly were becoming worse. Notwithstanding a statement from Austin to the effect the State of Texas could and would handle the oil situation production continued to mount in the East Texas area until the output ranged around 1,000,000 barrels daily although the fields' allowable was only 400,000 barrels. Proration enforcement ceased to be even a joke. There really was no such animal.

Crude and refined oil markets should strengthen immediately as a result of the active participation of the Federal Government. Everyone in the country knows the slogan at Washington is "quick action" and there is nothing to indicate that this slogan will not apply to efforts to put the oil industry back on its feet. It is realized the oil business is the keystone in the movement to re-establish normal business conditions throughout the country. It is of paramount importance to the business conditions of the country as a whole that stabilization of the petroleum industry be accomplished quickly.

Oil men, big and little, and all associations should get behind the government in its efforts to help and public opinion should brand as a slacker the producer of hot oil and the gasoline tax evader, both of whom have been responsible for the chaotic conditions prevailing in the oil business and for the holding back of the recovery of this vital industry.

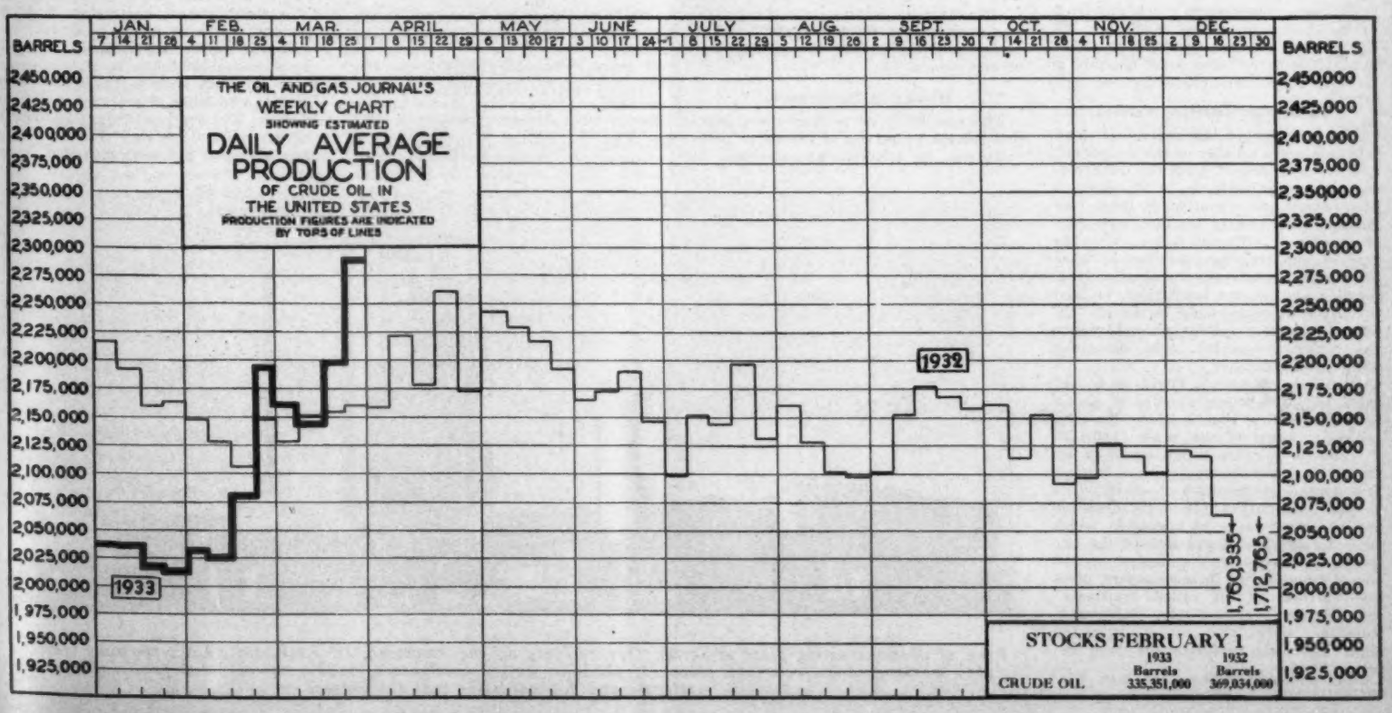
Crude Oil Production in the United States

Estimated daily average production for the week ending March 25, and a comparison with previous week and one year ago, follows:

	Mar. 25	Mar. 18	Mar. 26, 1932
Oklahoma—			
Oklahoma City	250,745	148,440	111,705
Seminole-St. Louis	112,810	110,515	117,305
Remainder of State	200,325	197,965	206,410
Total Oklahoma	563,880	456,920	435,420
East Texas—			
Lathrop	146,967	146,475	119,677
Kilgore	119,915	120,762	102,159
Joiner	128,832	129,424	105,910
*Total East Texas	395,714	396,661	327,746
West Texas	161,062	159,524	174,455
North Central Texas	75,095	74,555	74,596
Texas Panhandle	55,157	43,310	46,748
East Central Texas	58,586	58,835	55,260
Gulf Coast—Texas	150,535	148,116	103,536
Southwest Texas	53,015	53,442	59,825
Total State of Texas	949,164	934,443	842,166
Kansas	122,740	115,880	98,525
North Louisiana	31,195	32,290	27,905
Gulf Coast—Louisiana	35,317	35,403	28,312
Arkansas	30,825	30,670	34,145
Eastern Fields	104,000	104,000	113,000
Rocky Mountain area	75,934	76,292	86,348
California—			
Santa Fe Springs	39,000	47,500	65,000
Long Beach	53,500	51,750	79,500
Playa Del Rey	10,000	11,250	19,250
Elwood	14,250	13,250	15,750
Kettleman Hills	60,500	61,750	56,750
Remainder of State	193,750	229,500	256,750
Total California	371,000	415,000	493,000
Total United States	2,284,055	2,200,898	2,158,821

Increase 83,157 bbls. daily.

*Reported production.



Successfully Use Phenol as Selective Solvent in Manufacturing Lubricants and Special Oils

By R. K. STRATFORD, H. H. MOOR and O. S. POKORNY
Imperial Oil Refineries, Ltd.

Modern practice in the refining of lubricating oils has, from necessity, been directed toward the utilization of low grade distillates for the production of high grade finished oils. Until comparatively recent times such a practice has been impossible because of the limited methods of treating at the disposal of the refiner. The introduction of phenol as a selective solvent in the refining of such distillates has greatly increased the number of types of distillates which can be profitably used to produce high quality lubricating oils. In addition, this method of treating is especially suitable for the production of oils which must possess unusual characteristics, for example, insulating oils, airplane oils, turbine oils, etc.

This article outlines the development of the phenol process of selective solvent refining and shows how effective anhydrous phenol has proved to be in the practical treatment of lubricating oil distillates.

Before describing the action of phenol as a selective solvent refining agent, it will be well to outline some of the more important properties which a lubricating oil must possess in order to meet the present day requirements for a premium grade oil.

In general, an oil must have the desirable properties characteristic of Pennsylvania and Coastal oils and yet not have their less desirable features. Like a Pennsylvania oil, it must have a viscosity-temperature curve with a relatively flat slope, numerically best revealed by a high viscosity index[1]. Otherwise the oil will either give improper lubrication at high temperatures or the starting torque for a motor using the oil in cold weather will be excessive. The oil must also have the low carbon forming tendency and low cold test of Coastal oils.

In addition to the above factors, consumption in the motor, stability toward oxidation, gravity, color and flashpoint must be considered. The oil must show a minimum tendency to crack and/or to oxidize under operating conditions. The color of the oil, etc., even though of less importance nevertheless must measure up to certain specified requirements.

Phenol as Selective Solvent

The majority of lubricating oil distillates contain a number of the components which would detract from the quality of, and are undesirable in, a finished oil. The nature and quantity of these components vary greatly for distillates from crude oils of different origin. The purpose of any refining operation is to remove these substances as completely as possible and, at the same time, to leave the desirable components in the oil. Undiluted phenol possesses unique properties which accomplish this separation with great efficiency.

If a lubricating oil distillate is agitated with the proper amount of phenol at a temperature slightly above the crystallisation point of the latter (110-120° F.) and the mixture then allowed to settle, a two-layer system will be formed. The upper layer consists of oil in which a small amount of phenol is dissolved and the lower layer of phenol in which oil is in solution. Separation of the two layers, followed by distillation of the phenol from the oil in these layers, gives two portions of oil called "raffinate" and "extract" respectively. Subsequent inspection shows that the oil from the upper layer, the raffinate, has been improved in character by the treatment, most of the undesirable portions of the original distillate, chiefly unsaturated, aromatic and sulphur compounds, having been segregated in the extract.

[1]Dean and Davis, Chem. and Met. Eng. 34,618 (1929).

There are three important factors which have a direct bearing on the improved character and yield of the raffinate obtained by phenol treating; they are, treating temperature, proportion of phenol to oil, and the method of contacting the phenol and oil. The treating temperature is necessarily confined within the limits of the miscibility temperature of phenol and oil on the one hand, and the solidification temperature of the mixture on the other. An increase in temperature gives a better degree of improvement but lowers the yield of raffinate. An increase in the proportion of phenol to oil has an effect somewhat similar to that obtained with an increase in temperature. The optimum treating conditions, as far as these two factors are concerned, are largely governed by the properties of the distillate to be treated and the improvement desired. The contacting of phenol and oil may be carried out by a batch method or a countercurrent treatment. A single batch treatment is rarely adequate to bring about the desired improvement in a lubricating oil distillate. Successive batch treatments of the raffinate layer with fresh phenol will produce the desired improvement but the process lacks many advantages to be gained by the use of countercurrent treating. In countercurrent treating, raffinate and extract layers are continuously passed in opposite directions in a system of settlers and mixers. The process is described later in the section on "Description of the Plant."

It should be mentioned here that the action of the phenol is purely physical in nature, there being no accompanying loss of stock in acid sludge that must occur in an acid refining process. The separation of aromatic and unsaturated compounds from the paraffinic portions of the distillate results from the properties possessed by phenol of great preferential solubility toward the former class of compounds.

History of Development

The possibility of putting these selective solvent properties of phenol to practical use in refining was realized at least seven years ago. However, the early experiments were made with solutions of phenol plus some diluent and the process applied to the treatment of refined oil distillates.

F. Schick, in May, 1926, was granted a patent[2] covering the use of phenol plus a large number of diluents for the refining of hydrocarbon oils derived from mineral and other oils. In September of the same year, J. P. Fraser[3] obtained patent rights for a complete treating and recovery process, especially for the treatment of refined oil distillates, based on the use of phenol containing 5 to 15 per cent water. Beginning early in January, 1928, a very comprehensive series of experiments was undertaken covering the application of various solvents, and of phenol plus various diluents in particular, in the treatment of refined and lubricating oil distillates by R. K. Stratford and his associates, G. McIntyre, H. H. Moor and O. S. Pokorny of the Imperial Oil Refineries, Ltd., at Sarnia, Ontario, Canada.

About a year after the commencement of this work the advantages of nonaqueous phenol as applied to the treatment of lubricating oil distillates[4] were demonstrated. Following this discovery, intensive laboratory work was carried out to ascertain conditions for maximum treating efficiency. Towards the end of 1929 a small experimental treating plant, using countercurrent treating, was constructed and put into operation. Many types of lubricating oil distillates were treated in this unit with excellent results.

In May, 1930, the construction of a plant capable of treating 80 to 90 bbls. per hour was commenced at Sarnia, Canada, and in November of that year the plant began operation. Such satisfactory results have been obtained from the beginning up to the present time the original plant has only been modified in minor details.

Description of Plant

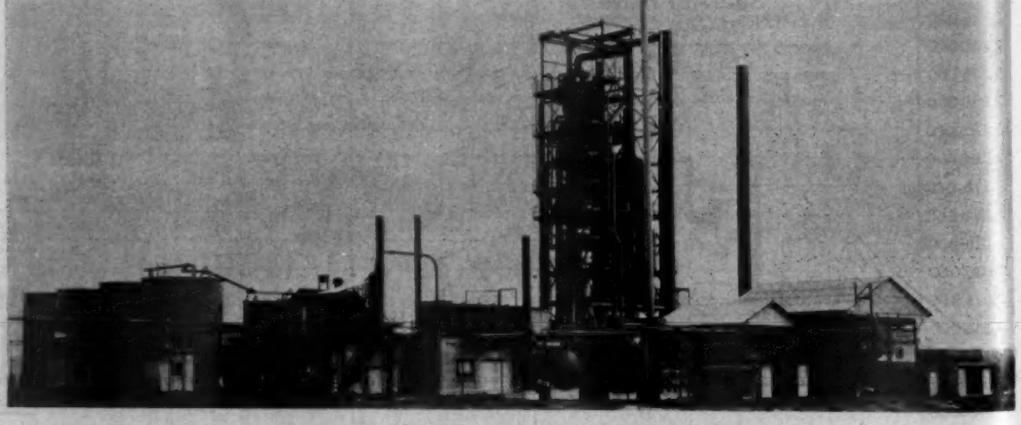
The plant operates in such a manner that the distillate is continuously treated and separated into extract and raffinate portions, the phenol being continuously reclaimed and re-used. The plant consists essentially of three parts; a countercurrent treater, a dephenolizer unit, and a phenol recovery unit. Figure 1 is a schematic diagram illustrating the complete treating process.

Preheated oil (110-120° F.) and phenol pass countercurrently through a treater consisting of seven Leaver mixers, seven settling drums, and the necessary pumps, etc. Treated oil is drawn from the top of the seventh settling drum and pumped to the tank from which the dephenolizing unit is charged. Spent phenol is discharged from the first settling drum through a cooler into a settling tank which is maintained at a temperature of 95-100° F. The light oil which separates from the cooled spent phenol in this tank is recycled to the countercurrent treater. The cooled spent phenol is discharged to a tank before being pumped to the phenol recovery unit.

The treated oil containing 8 to 15 per cent phenol is pumped to a pipe still from which the vapors pass to a 14-plate bubble tower operating under atmospheric pressure. The phenol coming overhead is condensed and flows into a reflux drum. A portion of this phenol is refluxed down the tower and the remainder flows to pure phenol storage. The bottoms of the bubble tower are sent to a six-plate vacuum stripper. A portion of the condensed overhead from this stripper is refluxed and the remainder recycled to the pipe still. The bottoms from this vacuum stripper are reboiled and recycled to a point below the first plate in the stripping tower. The bottoms are finally pumped from this tower, through a cooler, to dephenolized treated oil storage. The quantity of phenol (.005 per cent) in this treated oil is negligible.

The phenol recovery unit is similar to, but larger than, the dephenolizing unit. The spent phenol containing 25 to 30 per cent oil, is preheated in a vapor heat exchanger before entering the pipe still. Pure phenol is taken as a side stream from the fifth plate in the bubble tower, cooled, and then discharged to phenol storage. The overhead from this tower is chiefly phenolic water. The portion of this overhead not used as reflux is seg-

[2]German Patent, No. 429,444. To Dr. Friedrick Schick, granted May 27, 1926.
[3]British Patent, No. 273,351. To J. P. Fraser, the Burmah Oil Co. Applications dated January 25 and September 21, 1926.
[4]Canadian Patent, No. 308,405. R. K. Stratford, assigned to the Standard Oil Development Co. Issued February 3, 1931.



View of phenol treating plant at Sarnia, Ont. refinery of the Imperial Oil Refineries, Ltd., showing (left to right) working tanks, recovery plant for phenolic water, condensers, bubble towers, dephenolizing coil for raffinate and dephenolizing coil for extract

regated in storage and when sufficient accumulates, the phenol is readily recovered in a small recovery plant (not shown in Figure 1). The bottoms of the bubble tower are sent to a six-plate vacuum stripper. The portion of the condensed overhead from the vacuum stripper not used as reflux is recycled with the incoming spent phenol charged to the unit. The bottoms of this tower are reboiled and finally drawn off, cooled, and the dephenolized extract oil pumped to storage. The phenol content of this extract oil runs less than .07 per cent.

Results

Anhydrous phenol treating can be applied to almost any type of lubricating oil distillate and a marked improvement in the quality of the distillate will be obtained. In this brief discussion it is useless to attempt to present detailed data on improvements which can be obtained with various distillates cut from crudes of different origin. Therefore the discussion will be limited to a few of the Colombian distillates which have been processed in the phenol treating plant at Sarnia for the production of lubricating oils and oils for special purposes. Lastly, the utilization of the extract will be discussed.

As far as lubricating oil distillates are concerned, phenol treating has been found to increase the viscosity index, improve the gravity, stability, color, and lower the carbon residue and sulphur content. In addition, by narrow cutting of the distillate, a finished oil of very high flash for a given viscosity can be obtained. Table 1 in addition to illustrating typical improvements in viscosity index and gravity, gives the actual operating conditions and yields in treating three typical Colombian distillates.

The inspections given for the "raffinate" in Table 1 are for the phenol treated distillates before they have been clay contacted. The inspections of the finished oils will be found in a subsequent section (see Table 2).

The data given in Table 1 illustrates the following important results:

1. The improvements in the viscosity index, 45 points for the light, 56 points for the medium, and 49 points for the heavy distillate, are all excellent. It is to be emphasized that these are typical improvements in the viscosity index and that even greater improvements, if desired, can readily be obtained by varying the treating conditions.

2. The increase in gravity in each of the three distillates is great; from 21.7 to 27.8 for the light, 20.3 to 26.5 for the medium, and 17.4 to 25.8 for the heavy distillate.

3. While phenol treating causes a decrease in the viscosity at 210° F., at least one-half of this decrease would occur if the distillate was acid treated and in this latter case there would be practically no improvement in the viscosity index.

4. The flashpoints of 450, 480, and 525 are high for the treated distillates having viscosities of 60, 76 and 99 Saybolt seconds at 210° F. respectively.

5. The cold test of the light treated distillate is the same as that for the untreated stock. The increase in the cold test of the medium and heavy distillates is quite small. In practice, the cold test of the heavy distillate is reduced 10 to 15° F. by centrifugal separation of a slight wax haze.

6. The treating conditions vary from 125 to 165 per cent phenol and from 120 to 125° F.

Finished Lubricating Oils

Finished lubricating oils meeting the specifications of S.A.E. Nos. 30, 40, 50 and 60 oils are readily produced by phenol treatment of Colombian flash coil distillates of the proper viscosities, without the necessity of any other finishing process than clay contacting; except in the case of the 40, 50 and 60 oils which are dewaxed to remove a slight wax haze. At Sarnia, because of the comparatively small demand, S.A.E. 10 and 20 oils are usually made by vacuum rerunning a treated mixed distillate. It is evident that the small amount of finishing required for phenol treated distillates is an important advantage which this process enjoys. In actual plant processing at the Sarnia refinery, acid finishing of lubricating oil distillates has been eliminated and by the substitution of an active clay for a natural earth the quantity of clay required has been reduced as compared to what was required previously. Table 2 gives typical inspections of these finished oils produced from Colombian distillates and marked under the trade name of "Marvelubes."

It is evident from the inspections given in Table 2 that these finished oils have excellent properties:

1. For an oil of a given viscosity the viscosity index is high and the cold test is low.

2. The Sligh oxidation number and the carbon residue of each grade of oil is very low.

3. The steam emulsification numbers are low, especially for the heavier grades such as 40, 50 and 60 oils.

4. Without exception, the gravity and flash are high and the color excellent for each of the six grades listed.

It should be emphasized that all of these oils are prepared directly by phenol treating and clay finishing Colombian distillates and do not require the blending in of such stocks as bright stock.

The best evidence of the remarkable stability of phenol treated distillates is to be found in their use as airplane oils. Summer and winter grade oils can be produced by phenol treating suitable distillates followed by simple clay contacting (and centrifuging in the case of the heavier grade) for finishing the oils. These oils will meet the specifications of the British air ministry which include very severe oxidation and coke tests.

Table 3 gives an inspection of a typical airplane oil (Marvelube A-5) produced by phenol treating a 153 at 210° F. (S. U. seconds) distillate with 150 per cent phenol at 160° F., and finishing with 6 per cent natural clay.

TABLE 3—INSPECTION OF MARVELUBE A-5 AIRPLANE OIL

Gravity, A.P.I.	26.4
Flash, °F. (Cleveland O. C.)	510
Visc. S. U. @ 100° F.	1,462
Visc. S. U. @ 210° F.	101
Visc. absolute, in poises, @ 100° F.	2.73
Visc. absolute, in poises, @ 200° F.	0.211
A.S.T.M. color	3
Cold test at 18° F.*	1.16 c.m.
Free acid:	
Mineral	trace
Organic (gm KOH/100 gm oil)	0.003
Ash	trace
Oxidation ratio*	1.34
Coke No.*:	
Before oxidation	0.155
After oxidation	0.992
Viscosity index	83

*British Air Ministry General Specification, No. D.T.D. 109 for mineral lubricating oils, November, 1928.

The viscosity index, cold test and flashpoint of this oil are all exceptionally good when considered together. The coke number of 0.155 before oxidation is far below the specified limiting value of 0.65. After oxidation, the value of .992 is also well below the limiting value of 1 plus the value before oxidation, in this case 1.155. In addition the oxidation ratio of 1.34 is well below the limiting value of 2.

Transformer Oil

An excellent quality transformer oil is produced by light, low temperature, phenol treatment of a suitable distillate. Miscibility of phenol with the light distillate used for producing this oil is overcome by recycling a portion of the treated distillate back to the charge. A light lye wash, followed by vacuum rerunning and contacting with 3 per cent clay gives a transformer oil having the characteristics shown below:

TABLE 4—INSPECTION OF TRANSFORMER OIL

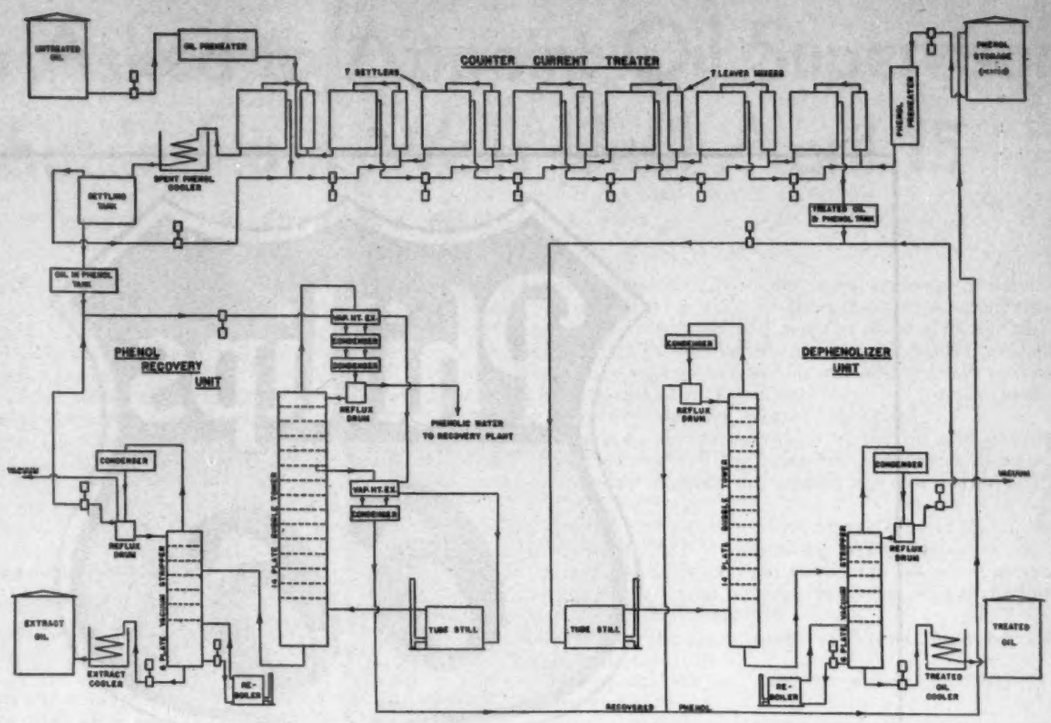
Gravity, A.P.I.	30.9
Flash	295
Visc. S. U. @ 100° F.	58
Cold test, pours at	—50°F.
Saybolt color	+16
Acid No.	0.013
Corrosion	Pass
Ammonia slop	Pass
Hydro electric power commission of Ontario sludge	Pass
Swedish General Electric sludge	Pass
Sulphur	0.25
S.E. No.	16

From the inspections given in Table 4, it is evident that the transformer oil has excellent viscosity-gravity and viscosity-flash relationships and a very low cold test. The oil will also pass various sludge and corrosion tests satisfactorily. The color is good, the sulphur content sufficiently low, and the acidity negligible.

Turbine Oils.—Recently, a complete series of turbine oils have been prepared by phenol treating. As a result of a very complete series of comparative oxidation tests on turbine oils, including some of the best competitive oils, it has been found that phenol treated distillates, finished by clay treatment only, are as good as anything on the market. These phenol treated oils will pass all the important tests applied to turbine oils and they show the greatest stability and resistance to oxidation and emulsification.

Additional Special Oils.—In addition

(Continued on Page 89)



Diagrammatic layout of phenol treating plant at the Sarnia, Ont. refinery of the Imperial Oil Refineries, Ltd.

TABLE 2—TYPICAL INSPECTIONS OF FINISHED LUBRICATING OILS

	Marvelube					
	"Ten"	"Twenty"	"Thirty"	"Forty"	"Fifty"	"Sixty"
Gravity	28.1	27.7	27.1	26.2	26.2	25.6
Flash	370	410	445	475	495	525
Fire	430	475	515	555	575	610
Visc. @ 100° F.	184	305	527	854	1,250	1,760
Visc. @ 130° F.	97	142	220	348	473	612
Visc. @ 210° F.	44	51.5	60	74.5	90	107
Viscosity index		80	75	75	75	75
Pour @	—25	—20	—10	0	+15	+20
Robinson color	17	14½	12½	10½	9¼	9
C.C.R.	(*)	0.01	0.04	0.10	.245	.450
A.S.T.M.	(*)	(*)	(*)	(*)	(†)	(†)
S.E. No.	60	84	125	155	165	115
Neutralization No.	.050	.050	.050	.050	.050	.050
Sligh oxidation	11.4	11.8	5.5	4.4	2.2	1.5

*Nil. †Trace.

TABLE 1—PHENOL TREATING COLOMBIAN DISTILLATES

Charging stock					Treat. conditions		Raffinate						Extract			
A.P.I. gravity	Visc. @ 100°F.	Visc. @ 210°F.	V.I.	P/S	% phenol	Temp. °F.	Yield on charge	A.P.I. gravity	Flash	Visc. @ 100°F.	Visc. @ 210°F.	V.I.	P/S	Yield on charge	A.P.I. gravity	Visc. @ 210°F.	P/S
21.7	822	66	40	—5/—10	125	120	60.0	27.8	450	483	60	85	—5/—10	40.0	12.4	99	40/35
20.3	1,985	93	23	5/0	147	120	61.8	26.5	480	870	76	79	15/10	38.2	10.5	227	55/50
17.4	4,670	146	28	30/25	165	125	53.3	25.8	525	1,490	99	77	45/40	46.7	9.8	518	95/90

AMAZING GAIN IN SALES

Jobbers increase their volume 50% to 200%

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The all-time record in winning the greatest number of car owners in the shortest time undoubtedly belongs to Phillips 66—the greater gasoline.

Jobbers quick to recognize this demand of motorists are enjoying immediate, amazing gains in sales—up to 200% in three months. Names and proof on request.

The low carbon content of Phillips bright stock makes an ideal motor oil for high compression engines.

Good territory open for responsible jobbers. Write or wire.

Also Phillips 66 Ethyl at the regular price of Ethyl Gasoline

Phillips Petroleum Company
Bartlesville, Oklahoma

Roosevelt Is Asked to Appoint Oil Supervisor and to Shut In Flush Wells Until April 15

By CHARLES E. KERN
Washington Bureau, The Oil and Gas Journal

WASHINGTON, D. C., Mar. 29.—President Roosevelt is considering and expected to take quick action on definite recommendations adopted unanimously here today at the close of the conference of oil producing states, oil industry associations, independent oil men and representatives of the American Petroleum Institute, called by Secretary of the Interior Harold L. Ickes. The recommendations, designed to solve the problems of the petroleum industry and re-establish quickly normal conditions in the oil business, include a shut down of all flush fields in Oklahoma, Texas, Kansas, California and New Mexico until April 15; the appointment by the President of a Federal advisor on a commission to secure compliance of the recommendations; and the enactment by Congress of suitable legislation to prevent the interstate transportation of hot oil. The Federal Government is also asked to aid in preventing gasoline tax evasion.

Report as Approved

At a full meeting of all delegates to the oil convention Secretary Ickes presented the following unanimous resolution which meets his approval:

The three committees, respectively representing (1) the governors of the oil producing states or their duly authorized delegates; (2) the oil and gas associations representing independent producers of oil and gas in the United States, and (3) the major oil and gas producing and importing companies, after conferring together, have unanimously agreed to recommend the following program to you, in order to meet the existing emergency in the oil and gas industry and to provide the basis for conservation and scientific future development of the oil and gas resources of our country:

A. To meet the existing emergency, the committees unanimously recommend:

1. That the President of the United States be requested to transmit this report to the governors of California, Kansas, Oklahoma, Texas and New Mexico, and to call upon them immediately to close all flush pools in their respective states until the fifteenth day of April next, excepting wells producing more than 10 per cent of water, which would be damaged irreparably by a complete shut down.

2. That the President of the United States be requested to call upon the governors and legislatures of the principal oil producing states which have no adequate or no general conservancy statute to adopt such a statute immediately in order to further the conservation and scientific and more orderly development of the oil and gas resources of such states and in order to enable full co-operation toward those ends between all the principal producing states.

Prohibit Transportation of Hot Oil

That the President of the United States be requested immediately to recommend to Congress the adoption of a law prohibiting the transportation in interstate and foreign commerce of any oil or the products thereof produced or manufactured in any state in violation of the laws thereof, and providing adequate penalties for violations of the said law.

4. That the President of the United States be requested (A) to require strict enforcement of the Federal gasoline tax and pipe line tax and vigorous prosecution of evaders thereof, so long as the said taxes remain in effect, and (B) to instruct the Bureau of Internal Revenue, to ascertain at the time of collecting the tax, the consignor, consignee, destination and quantity being shipped by each refinery, and (C) to instruct the said bureau to transmit the said information to the tax collecting authorities of those states into which the gasoline is to be moved.

5. That the President of the United States be requested fully to endorse the recommendations made herein and to appeal to the states, and to all those engaged in the oil and gas industry, faithfully to co-operate in the enforcement and observance of the said recommendations and in the limitation of production in harmony with a fair allocation of the national consumptive demand.

6. We further recommend that the President submit to Congress a request for emergency legislation authorizing him to appoint a personal representative to co-operate with the duly constituted authorities of the several oil producing states in bringing about a compliance on the part of said states with the program covered by these recommendations, and to advise and co-operate with the industry in complying with that portion of the program recommended for action by the industry; such act of Congress to be effective during the emergency only, and whenever in the opinion of the President of the United States the emergency in the oil industry has passed, thereupon, by proclamation, the President may declare the emergency ended and the office, thereby created, abolished.

B. To provide a basis for conservation of the oil and gas resources of the United States and the scientific future development of the oil and gas industry therein, the committees are unanimously of the opinion:

1. That the Government of the United States can aid and assist in the following respects: (A) By initiating a comprehensive and scientific study of the entire subject and publishing, as soon as possible, a report of the facts found, conclusions reached and recommendations made with reference thereto.

(B) By imposing an adequate competitive tariff on crude petroleum and the products thereof.

(C) By eliminating the tax on domestic refined products and the Federal pipe line tax.

(D) By vigorous prosecution for evasion of the Federal gasoline tax and pipe line tax if such taxes are to be continued.

(E) By permitting drilling on the public lands to be delayed.

(F) By eliminating imports to the average for the last six months of 1932.

(G) By continuing the Federal Oil Conservation Board as an advisory body.

What the States Can Do

2. That the producing states can aid and assist in the following respects: (A) By the enactment, where necessary, of adequate state laws under which conservation can be enforced.

(B) By the issuance of valid orders under such conservation statutes.

(C) By strict enforcement of the orders issued.

(D) By the equitable allocation of the allowed production as between pools.

(E) By limiting production of crude oil to the requirements of the consumer of refined products, or crude petroleum as such.

(F) By reaching an agreement with each other on the total market demand for crude petroleum and a proper allocation of this demand as between the producing states.

Note—Pending a more complete study of the subject, the production in the United States should for the time being be limited to 2,000,000 bbls. per day, allocated as follows:

Texas	786,242 bbls.
Oklahoma	417,690 bbls.
Kansas	93,366 bbls.
California	432,432 bbls.
All other states	270,270 bbls.

(G) By rigidly enforcing the gasoline tax laws so as to prevent tax evasion, by preventing the diversion of the tax from highway uses, and by a reduction of the tax wherever at all possible.

(H) By encouraging permissive units operating under voluntary agreements.

Wherein Industry Can Help

3. That the industry can aid and assist in the following respects: (A) By actively supporting governmental agencies in their efforts to make and enforce valid orders.

(B) By refraining from producing oil unlawfully and refusing to transport or purchase oil unlawfully produced.

(C) By marketing arrangements with limited areas conforming to the principle announced by the Supreme Court in the Appalachian coals case.

(D) By diligent efforts to promote permissive unit operation under voluntary agreements.

(E) By avoiding excessive withdrawals from storage.

(F) By limiting drilling to the absolute minimum.

(Continued on Page 30)

To Seek Improvements in Marketing Practices at Hot Springs Meeting of Western Refiners

By W. T. ZIEGENHAIN

One of the most important questions to be brought before those attending the annual meeting of the Western Petroleum Refiners Association in Hot Springs, Ark., April 5 and 6, will be that of regrading Mid-Continent refinery gasolines according to octane number. The association members will adopt a definite change and each has been asked to attend the meetings prepared to offer suggestions and to approve or oppose definite recommendations that might be offered at the meetings. The subject will first be discussed by the technical committee. The committee will then make a definite recommendation of some form which will be read before the executive

GEORGE D. LOCKE

Vice President, Barnsdall Refineries, Inc., President, Western Petroleum Refiners Association.

meeting on the following day for discussion and final action.

Except for the general belief that a change should be made, there is not a uniformity of ideas regarding just what the new brackets should be. Several suggestions have already been made in informal meetings of technical groups and these may be presented.

The technical men are mindful of the effect of reducing the octane value of the present gasolines when the new motor method of determining the octane value is generally adopted.

After pooling the tests on hundreds of samples of gasoline made in the Mid-Continent it was generally agreed that the loss in octane value would approximate 5 per cent as a result of changing the test method. As an example, a Mid-Continent gasoline now having an octane value of 60 will have a value of 57 when the new motor method of test is put into effect. It is also true that while the average of all gasolines will lose only 5 per cent in octane value, there are some motor fuels which will lose 10 to 15 per cent. So, in making a change in the division of grades according to octane value, the effect of the adoption of the motor method must be considered at the same time.

Various Proposals

At least three suggestions will be presented before the technical meeting for consideration. One of these will be that refinery gasolines in the Mid-Continent be graded and priced as follows:

1. Below 60 octane number.
2. 60 octane number and above.

Such division provides the same number of grades as found in the retail market with Ethyl Gasoline excluded and it is reasonable to make this exception since the latter is not sold except through licensed dealers and Ethyl Gasoline does not enter the refinery spot market in a competitive manner. The method finds some objection since it does not provide for a premium for those gasolines of exceptionally high octane value. Those refiners who have built up a market for gasolines having 65 octane value and above, such gasolines as made from selected Arkansas and North Louisiana crudes, feel that a premium should be derived for this type of product. They request that a regular price classification be provided for it in the adopted series of brackets.

This has led to the second proposal which is likely to be presented before the technical meeting for consideration. This proposal would establish three grades as follows:

1. Below 60 octane number.
2. 60 to 64 octane number inclusive.
3. 65 octane number and above.

While this provides a wider price classification and removes the objection with regard to the high octane product the actual divisions of the range apparently do not satisfy certain groups who have been discussing a third method.

This third suggestion would provide the following division of the range:

1. Below 59 octane number.
2. 59 to 64 octane number inclusive.
3. 65 octane number and above.

In all three of these suggested changes it may be seen that a better gasoline will be required than under the old or present method of pricing according to octane number. At present the lowest grade includes gasolines having an octane number below 57 using the old research method of test. Assuming the first division is made at 59 or 60 octane, and with the certainty that the new motor method of test will come into general use April 1, the effect of these two changes will mean that the gasoline will have to be 5 or 6 octane units better to just meet the minimum requirement. This will throw much of the motor fuel that is now straightrun East Texas gasoline into the lowest grade whereas this gasoline has been going out under the middle price classification.

Practically all straightrun gasolines made from Mid-Continent crude will be affected in the same manner but the East Texas straightrun is of greatest concern because it has consistently met the requirements of the middle classification in octane but much of it has been inferior in some other quality. The effect has been that the price structure on all Mid-Continent gasoline has suffered as the result of this.

Another important discussion to be held before the executive session is that of the effect of published quotations on the general market. Some executives have expressed the belief that daily published prices are being derived from sources which do not reflect the actual strength of the market. They object to the Chicago market establishing the market throughout the Middle West. These executives also state that a system of publishing prices could be worked out whereby companies would announce their price for a week in advance and trading would be carried on in "futures."

In just what manner such a system could be worked out is not clear and possibly further statements will be made before the convention. Other executives subscribe to a similar plan except that they prefer that no published prices be used in contracts but that each company maintain its own price quoting system. This of course would permit a wide range of quotations but those who advocate such a procedure state this will not be a handicap.

While the present method of basing contracts on published prices may seem to work a hardship and efforts are being made to modify it in some manner, those who are closest to the actual sales work agree, that the system itself is not entirely to blame. They agree that if the refinery sales managers choose to turn away from the use of such prices this portion of the problem would be solved

HOWARD BENNETTE

Managing Director of Western Petroleum Refiners Association.

but there is no guarantee a better system would be developed. Also, even though the general use of published prices should be discontinued there will be no less interest in the prices the papers will carry and the publishing of such prices might be expanded into the hands of less responsible parties than now in the work. These arguments will be brought before the convention and the views of R. R. Irwin, of the White Eagle Oil Corp., and P. M. Miskell of the Empire Oil & Refining Co. is being awaited as part of their general discussion of marketing practices during the executive session.

Technical Meeting

Although marketing will probably hold the interest of the majority of those attending the two-day meeting, several important papers will be presented by technologists that have direct and immediate application to refinery operations. In the opening meeting on Wednesday with R. R. Irwin as chairman, E. C. Higgins, Jr., of the Process Development Co., will read a paper outlining the use of various reagents for the sweetening of gasolines. He will deal particularly with the use of magnesium hydroxide as a sweetening agent.

Because of the growing need and general use of inhibitors Walter Schuemann's paper on the subject should prove exceptionally interesting to Mid-Continent refiners. Another paper of equal importance to refiners will be delivered by Dr. Sidney

(Continued on Page 90)

TWENTY-FIRST ANNUAL MEETING, WESTERN PETROLEUM REFINERS ASSOCIATION

Arlington Hotel, Hot Springs, Arkansas, April 5 and 6, 1933

Technical Session—1:30 P. M., April 5

Opening Remarks: R. R. Irwin, White Eagle Oil Corp., presiding.
"Economics of Gasoline Sweetening," by E. C. Higgins, Jr., Process Development Co.
Discussion.
"Gasoline Inhibitors," by Walter Schuemann, Empire Oil & Refining Co.
Discussion.
"Effect of Acid Treatment on the Octane Value of Pressure Gasoline," by Dr. Sidney Born, University of Tulsa.
Discussion.
"Refinery Maintenance and Operations," led by J. J. Allinson, Lion Oil Refining Co.
Open Forum.

Morning Session—9:30 A. M., April 6

R. R. Irwin, presiding.
"Unit Support of Furnace Walls," by B. W. Vinson, B. W. Vinson Co.
Discussion.
"Revision of Octane Brackets," discussion led by R. R. Irwin.
Open Forum.

General Session—1:30 P. M., April 6

Opening Remarks: George D. Locke, Barnsdall Refineries, Inc., presiding.
President's Address: George D. Locke, president, Western Petroleum Refiners Association.
Appointment of Committees.
"The Road Oil Outlook for the Mid-Continent Refiner," by H. G. Nevitt, White Eagle Oil Corp.
Discussion.
Report of Committee on Revision of Octane Brackets.
"Extent of Executive Interest in the Effect of Marketing Policies," by P. M. Miskell, Empire Oil & Refining Co.
Discussion.
"Can Any Improvement be Made in Our Present Destructive Method of Tank Car Selling," by R. R. Irwin, White Eagle Oil Corp.
Discussion.
Report of Committees.
Election of Officers and Directors.

Punch

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Geologists Elect F. R. Clark of Tulsa, President; Houston Convention Is Most Successful

By NEIL WILLIAMS

HOUSTON, Tex., Mar. 27.—Not until the true geological concept of oil field accumulation is accepted in its entirety by all, including fee and royalty owners, petroleum operators, legislators and the courts, and not until its logical consequences are upheld by all, will the chaos or unrestrained production cease to threaten. This was the warning of Dr. Frederic H. Lahee, chief geologist of the Sun Oil Co., Dallas, Tex., and president of the American Association of Petroleum Geologists the past year, in his opening presidential address at the eighteenth annual convention of the organization in Houston March 23, 24 and 25.

The convention was regarded generally among the visiting geologists as one of the most successful which has been held to date, and, from a registration standpoint it far exceeded expectations. A total of approximately 1,050 members and visitors were registered for the three-day event. The interest which has been centered on wildcat exploration and development on the Gulf Coast was contributory to the success of the meeting.

The seventh annual meeting of the Society of Economic Paleontologists and Mineralogists and the fourth annual meeting of the Society of Petroleum Geophysicists were held in conjunction with the meeting of the geological association. Their individual programs dealt solely with technical presentations and discussions.

Election of Officers

At the annual business session on the closing morning of the convention, Frank R. Clark, chief geologist of the Mid-Kansas Oil & Gas Co., Tulsa, Okla., was elected president of the geological association for the ensuing year to succeed Doctor Lahee. Upon the motion of Dr. Donald C. Barton of Houston, who was a nominee for the office, the election of Mr. Clark was made unanimous.

George Sawtelle, vice president of the Kirby Petroleum Co., Houston, Tex., was elected vice president without opposition, while William B. Heroy of the Sinclair Exploration Co., New York, was re-elected secretary-treasurer unanimously. L. C. Snider, chief geologist of Henry L. Doherty & Co., New York, was chosen editor of publications without opposition.

The Society of Petroleum Geophysicists elected the following officers: President, Eugene E. McDermott, Geophysical Service, Inc., Dallas, to succeed Paul Weaver of Houston; vice president, L. P. Schuhmacher, Torsion Balance Exploration Co., Houston; secretary-treasurer, John F. Weinzierl, consulting geophysicist, Houston; and editor, L. Blau, Humble Oil & Refining Co., Houston.

New officers chosen by the Society of Economic Paleontologists and Mineralogists were: President, Dr. F. B. Plummer, Bureau of Economic Geology, University of Texas, Austin; vice president, H. G. Schenck, Leland Stanford University, Palo Alto, Calif.; secretary-treasurer, Gayle Scott, Texas Christian University, Fort Worth, and editor, R. C. Moore, University of Kansas.

Doctor Lahee, in his keynote address, stated that the geological concept of oil accumulation is the most significant contribution made by petroleum geology to science and to the industry, and a contribution far-reaching in its import. The concept is the proof, substantiated by tens of thousands of wells, that an oil pool is an isolated unit, a body of oil, or of oil and gas, which is bounded above, below and on all sides, although the body of fluid is contained in the pores of a rock; and that these fluids are restrained under considerable pressure, depending, among other things, upon depth. Prior to drilling, the pool is essentially in static equilibrium, in fixed relations vertically below certain properties on the ground or surface.

This concept, he stated, is absolutely vital to further progress in the industry. Failure to support a rational plan of oil pool development may be partly due to selfish interests, but it is often more largely due to ignorance of the real facts. He urged that the association as a group of technical men and women consider it a duty and a privilege to take every reasonable opportunity of informing the public on the simple facts of oil and gas occurrence.

The increasing problems and difficulties of geologists as the chances for discovering new fields from surface indications grow less and less, and the necessity of closer and closer study by geologists were emphasized by Doctor Lahee, who explained that future discoveries might have to come from subsurface correlations extending over wide areas. From this standpoint, he pictured subsurface geology has grown to be of major importance with improving technique, and now might be considered the backbone of modern geology.

Although the convention was held at Houston because of the interest at this time in the Gulf Coast, and although considerable attention was directed toward the symposium of Gulf Coast fields and geological technical subjects, the program also included a well rounded list of subjects covering every district, and general geological discussions.

Opening Session

At the opening session following the address by Doctor Lahee, H. D. Miser presented a discussion on the "Relation of the Ouachita Syncline to Oil and Gas Fields of the Southern Mid-Continent Region." In this he pictured by maps how the occurrence and distribution of much oil and gas in the southern Mid-Continent region appeared to have been influenced by the structural deformation of the Paleozoic rocks of the geosyncline and by the effect of the deformation on adjacent regions. He pointed out that the Ouachita geosyncline separates areas yielding Cretaceous and Tertiary oil and gas on its Gulfward side from areas of Paleozoic oil and gas on the northwest side.

A. L. Levorsen gave a summary of a paper he is preparing on "Paleogeology," which he defined as the science of geology of ancient time. His studies and maps showing the areal geology of the United States at different periods in its geological history were particularly interesting.

"Source Beds in Some Oil Producing Regions," was the subject discussed by Parker D. Trask, who, with Harald E. Hammer and W. Ross Keyte, is making an extensive study along this line. He pointed out that the period of time shortly after the deposition of sediments probably is of major importance in the generation of petroleum.

Other papers of general interest presented at the various sessions included "Oil Bearing Pliocene Beds of Southern California," by R. D. Reed; "Structural History of the Arbuckle Mountains, Oklahoma, in Pennsylvanian Time," Robert Dott; "Nature and Mechanics of Low-Angle Overthrusting as Illustrated by the Cumberland Overthrust Block," John L. Rich; "A Study of Bottom Hole Pressures in the East Texas Field," D. M. Collingwood and F. E. Heath; "Value of Gas Conservation and Efficient Use of Natural Water Drive as Demonstrated by Laboratory Models," H. D. Wilde, Jr., and Frederic H. Lahee, and "Permeability Experiments on Cores of Woodbine Sand," R. B. Whitehead, G. Kemp and R. H. Fash.

Oil and Water Movement

The latter, presented by Mr. Whitehead, created the greatest amount of comment and stir of any at the convention in view of the somewhat revolutionary conclusions drawn concerning the effect of oil and water movement through sands. The conclusions were to the effect that intermittent flow of wells, such as practiced by many operators in East Texas, was not advisable and might prove disastrous, and also that under proration and restricted production of fields close spacing probably should be necessary to obtain the recovery from the sand without waste.

Mr. Whitehead did not offer these conclusions as established facts but only for what his numerous experiments with sand cores tended to show. His experiments, conducted in a specially constructed device, which he demonstrated by lantern slides, indicated that in the movement of oil and water through sands there was a readjustment or change in the position or arrangement of the tiny sand grains each time the flow was stopped or started which affected the recovery of oil. In the tests on many core samples, each time oil was forced through the samples the rate of flow decreased, and the rate of flow of water injected into sands which had contained oil was materially slower than the rate of oil flow.

As to spacing of wells, Mr. Whitehead expressed the opinion that possibly under restricted production one well would not effectively drain an area within a distance of more than 300 feet. He based his opinion on the belief that production under restriction is so small comparatively that there is no movement of oil to speak of except immediately at the bottom of the well and that reservoir energy

(Continued on Page 89)

Geophysicists Urge Care About the Books You Leave Lying Around

By A. P. EYE
Correspondent Extraordinary

HOUSTON, Tex., Mar. 25.—The American Association of Petroleum Geologists, which held its annual convention here this week, is being highly commended for its efforts to remove certain notions regarding geophysical instruments and the work done with them. There's that idea, for instance, that the seismograph is responsible for earthquakes. Some folks blamed the recent earthquake in California on the fact that so many geophysicists were gathering here in one spot.

Such misconceptions, the geophysicists say, are traceable to erroneous impressions acquired in youth. More watchful training of the young and a more intelligent guidance of their reading are among remedies suggested. Under the present system of education a little boy, with reasoning and analytical faculties undeveloped, picks up say Ambronn's volume on "Elements of Geophysics," which his father has thoughtlessly left on the piano. As the name indicates, the book is for beginners and presents its subject in simple language.

Opening the pages at random, the little boy reads, "It is noteworthy that the magnetic inhomogeneities in the crust of the earth can influence the temporary fluctuations of the earth's magnetic field."

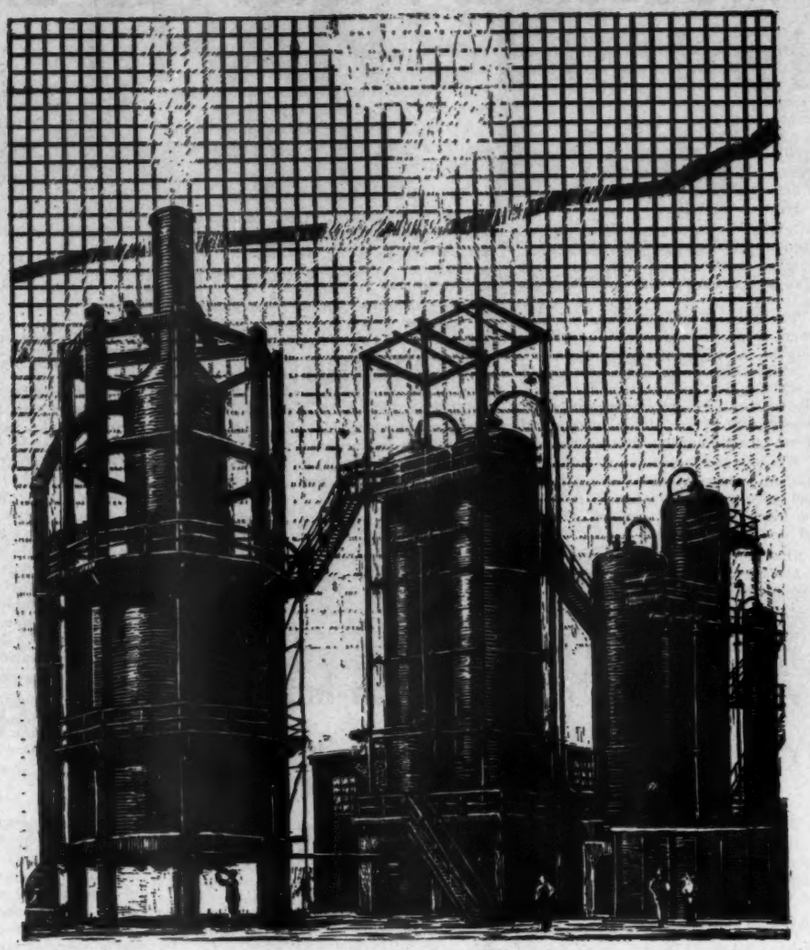
Instantly his attention is arrested. Here is something that nobody, not even his mother, ever told him. Reading further, he finds that "the epicentrum of an earthquake is that place on the surface of the earth which lies directly above the real quake focus in the subsurface (the hypocentrum)."

His night work is forgotten. He starts guiltily when his mother tells him it is bedtime. Stealthily he slips the book under his pillow, and after his prayers and the goodnight kiss he turns on the bedlight.

"The localizing of the earthquake center," he discovers, "follows on the basis of the macroseismic observation from the assumption that the hypocentrum must lie under the most strongly disturbed epicentral region."

Aquiver with excitement, the little boy reads on and on, far into the night. The mischief is done. He goes on into the years ahead ignorant that there is any difference between the well-behaved little temblor made by the seismologist and the old earth-rocking cataclysm that turns 30 stories and penthouse into a jigsaw puzzle.

It was agreed by the nation's leading geologists and geophysicists at their meeting here that the first step to be taken is to caution fathers about the kind of books they leave lying around the house.



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Economic Aspect of Utilizing Alcohols Made From Farm Products as Motor Fuel Blend

The ordinary alcohol of commerce contains 95 per cent of alcohol and 5 per cent of water, the highest concentration that can be obtained by the usual distillation procedures. This alcohol is not miscible with gasoline in all proportions. In Europe it is common practice to dehydrate the alcohol to a strength of 99 per cent which renders it miscible with gasoline. This can easily be done by an inexpensive process, involving a special distillation with benzene or gasoline.

Instead of using 99 per cent alcohol in making the blends with gasoline, the ordinary 95 per cent alcohol can be blended if a third substance be added which has the ability to bring these materials into solution. Several such blending agents are known. In general alcohols of higher molecular weight, such as normal butyl alcohol, are quite effective. Acetone, a ketone, is considerably less effective, but it is possible that some of the higher ketones may be satisfactory. Both butyl alcohol and acetone can be made by fermentation of agricultural products. Basic amines such as triethyl amine, and some of the fatty acids such as oleic acid are said to be excellent blending agents. In general, gasolines with a high content of aromatic hydrocarbons mix more readily with 95 per cent alcohol than do those containing mainly aliphates. Gasolines containing large amounts of low boiling constituents are superior in their ability to mix with 95 per cent alcohol. Research on the quantitative studies of blending agents is in progress.

ALCOHOL MOTOR FUEL BLENDS

The accompanying article is the second half of a nontechnical discussion of the results of an investigation conducted by the various departments of Iowa State College on the question of utilizing chemicals made from agricultural products in motor fuel blends. The first half of the report was published in The Oil and Gas Journal March 16, 1933, page 10.

A considerable amount of gasoline is now being manufactured by cracking processes. Cracked gasolines contain a large proportion of unsaturated hydrocarbons which tend, on exposure to air and sunlight, to form gums to such an extent as to cause serious difficulties. Cracked gasolines when fresh have a very high antiknock rating, but this rating falls with the formation of the gum. The stabilization of cracked fuels has been given a great deal of consideration and many substances which decrease the rate of gum formation have been found. It is claimed in the literature that ethyl alcohol, in concentrations of from 5 to 10 per cent is quite effective in decreasing this gum formation.

In planning for the use of alcohol-gasoline blends on any large scale, careful consideration must be given to the matter of carrying out the blending process. It would seem unnecessary to ship alcohol to the refinery for blending, when the alcohol is produced in the region in which the fuel is to be used. This is a problem which the petroleum industry can easily handle.

Ethyl Alcohol as a Motor Fuel

A great deal of work has been done on ethyl alcohol as a fuel for internal combustion engines both alone and blended with gasoline. In Table 1 are listed the properties of gasoline and alcohols which are of greatest importance in determining the relative values of these materials as fuels. Three alcohols are listed, menthanol (wood alcohol), ethyl alcohol and n-butyl alcohol, since these are the three produced in largest quantities. In recent years other alcohols, such as amyl, secondary butyl and isobutyl have been made synthetically at costs which might allow their inclusion in small quantities in motor fuel, but data on the use of these in fuels are not available.

The claims as to the merit of alcohol as a motor fuel are not fully established. The claims made in the literature may be summarized under the following six points:

1. The heat of combustion of alcohol is lower than that of gasoline, volume for volume. Alcohol vapors, on the other hand, will stand much higher compressions without detonation than will gasoline. In suitable high compression motors, the power output from alcohol may equal that from gasoline in our present motors.
2. While present motors are not suitable for utilising alcohol alone as a motor fuel, alcohol gasoline blends containing as high as 20 per cent of alcohol can be satisfactorily used.
3. Alcohol is a cleaner burning fuel than gasoline; alcohol-gasoline blends probably have this same advantage.
4. With alcohol or alcohol-gasoline blends better top cylinder lubrication is effected.
5. The alcohol-gasoline blends have very desirable antiknock properties.
6. The use of alcohol-gasoline blends results in lessened oil dilution and oil consumption.

Alcohol-Gasoline Blends

The investigations that have so far been carried out at Iowa State College are primarily of an exploratory nature and should in no sense be regared as comprehensive or complete. The investigations made by several departments of the college have been conducted along three lines: (1) A determination of the antiknock properties, or octane rating of various alcohol-gasoline blends; (2) a comparison of alcohol-gasoline blends and regular gasolines in so far as engine performance, acceleration, hill-climbing ability, etc., are concerned; and (3) a comparison of the mileage obtained with regular gasoline and alcohol-gasoline blends.

1. Antiknock Properties.—Motor fuels are frequently rated on their "octane number." This rating is a comparative measure of the antiknock property of a fuel. Fuels with higher octane ratings can be used in motors with higher compressions and the operating efficiency thereby increased. Regular nonpremium gasolines have an octane rating of about 60. The tests made by the mechanical engineering department have shown that the addition of 10 per cent of ethyl alcohol will raise this rating to about 69, while the addition of 20 per cent ethyl alcohol raises the rating to about 82. Experimental data on octane ratings of alcohol-gasoline blends are given in Table 2.

TABLE 2—COMPARATIVE ANTIKNOCK PROPERTIES OF GASOLINE AND ALCOHOL-GASOLINE BLENDS

Fuel—	Octane number	Increase due to alcohol
Base fuel ("regular" gasoline)	56	..
Base fuel plus 10% alcohol ..	65	9
Base fuel plus 20% alcohol ..	80	24

These results indicate that it would be necessary to add about 15 per cent alcohol to the base fuel to equal the results obtained by adding the usual amount of lead tetraethyl to the same fuel. Until recently the requirement for ethyl gasoline was octane 72, which value would be shown by the base fuel of octane 60 plus about 12 per cent of alcohol. Since all base fuels do not respond in the same way to the addition of alcohol, benzene or lead tetraethyl or ether antidetonants, it is not advisable to place the above estimates on a more definite basis. A large number of other determinations should be made, using various base fuels.

2. Performance Tests.—It is rather difficult to summarize the observations so far made on the behavior of alcohol blends in a number of privately owned cars. The following represents a fair statement of these qualitative observations:

(a) Tests of fuels consisting of anhydrous alcohol and gasoline.

In general the results obtained with this type of fuel have not been entirely satisfactory from all viewpoints. With one gasoline, the addition of alcohol produced an improvement in performance. The acceleration was improved and the engine operated more smoothly and quietly. The 10 per cent blend seemed to have antiknock properties equal to present premium fuels. With another gasoline, the addition of 10 per cent alcohol resulted in poorer acceleration, although the antiknock properties were as pronounced as in the former case. The results with 20 per cent blends were much the same as those with the 10 per cent blends.

With any of the blends used, there was no difference observed in the case of starting. In general most of the observers believed engine performance was smoother and there was a feeling that there was greater flexibility. An automobile mechanic might express the feeling that the engine performance was "sweeter." The automotive engineer would describe the performance by saying that alcohol effectively eliminates "engine roughness."

(b) Tests of fuels consisting of alcohol (95 per cent strength), gasoline and various blending agents.

In these tests the higher molecular weight alcohols, such as butyl alcohol, and ketones such as acetone have been used as blending agents. Preliminary tests indicated that the addition of these components had such pronounced advantages that it is hoped to extend studies along this line.

Practically all of the cars used in tests of this type of fuel showed improved acceleration with the blend. This improved acceleration was particularly pronounced at speeds below about 30 miles per hour, and in large bore engines of high compression ratio. Associated with this improved acceleration were smoother, quiet-

(Continued on Page 33)

Wyoming Oil Man Is Much Impressed by the Possibilities for Oil in Chile

By C. M. HARDMAN

VALPARAISO, Chile, Mar. 20.—We have just returned from a survey of what in time may be one of the world's wonder oil fields. This is the extreme southern part of Chile. This is a very interesting country and if the same geological conditions existed in the United States there would be another oil boom, or at least a rush to secure acreage.

We were shown gas seepages that have been burning at different times for hundreds of years. On the island of Tierra del Fuego we set fire to several of these. We also saw several seepages of oil on the mainland side.

The Chilean government has attempted to drill on the mainland and has started three wells. All three wells have had a showing of oil and gas. The deepest well (1,312 feet) will make about 7 bbls. per day with a strong pressure of gas. This oil is 42 gravity of a paraffin base. The government has two light (Belgian made) rotary rigs, and with this equipment it will be impossible for them to make a real test.

This is the only place in Chile where the stratified formations are known to be in place. There are from 2,500 to 3,000 feet of Tertiary and the geologists agree that a well should be drilled to a depth of 4,000 feet or more to make a fair test. Such a test is expected to be started this year as there are several American companies and one British company trying to get a concession from the government.

The laws of Chile at present do not permit foreign companies to operate, but these laws will be changed within the next three months. There is a bill in Congress to be considered this month that will allow foreign capital to exploit and operate on very liberal terms. It is generally believed the bill will pass both houses as the new president favors it.

There are at present four applications on file in the office of mines and petroleum for concessions which will receive first consideration under the new laws when passed. One is by a large American company, one by a large British company and two by Chileans who are acting for American capital. Two American companies have geologists in the field and the government has a German geologist working.

There are millions of acres that have never been explored or seen by a geologist and this country has great possibilities. The transportation is mostly by water and it is possible to work every month of the year. The only disagreeable feature is a strong wind that blows the four months of winter. But as a whole the climate is better than we experienced in Wyoming.

The government made an appropriation yesterday of 2,000,000 pesos to drill another well. This is about $50,000 in United States currency at the present rate of exchange. (Dollars are selling for 40 pesos on the street.) This money will be spent without results as it is impossible for them to drill 1,500 feet with the equipment they have. Chile is absolutely broke and its only salvation is to get oil in commercial quantities. The copper mines are shut down, as well as the nitrate mines. Her only hope is to let some foreign companies with capital come in and drill for oil.

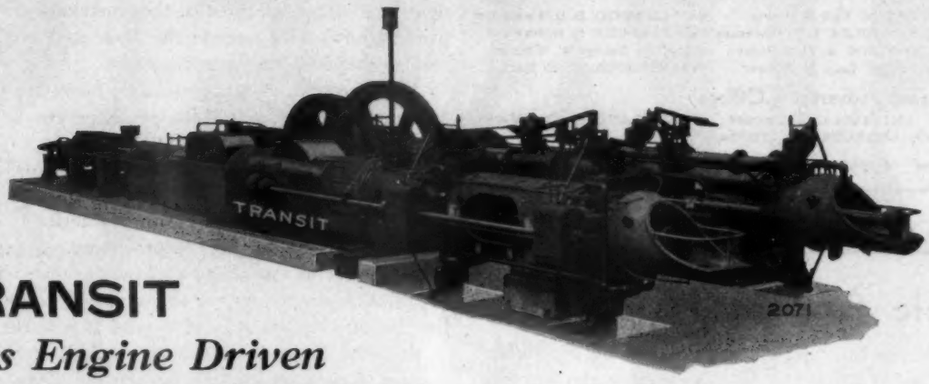
I advise American oil interests to keep an eye on Chile, as Chile may affect the oil industry in the near future.

The daily newspapers carry stories every day about oil. Most of the oil news is very funny for anyone to read who knows anything about the oil business. Every day some farmer or miner brings in a report of an oil discovery some place in the mountains. Everything concerning oil is published, and everyone is looking to oil as the only salvation of Chile. It is possible that oil will save Chile from bankruptcy if the present government will enact proper petroleum laws.

TRANSIT helps refiners to reduce costs

BY enabling them to reduce the cost of power; and at the same time guaranteeing them the utmost in dependable pump performance for the most exacting of services—that of

PUMPING HOT OIL



TRANSIT
Gas Engine Driven
HOT OIL PUMPS

"IT DOES SEEM TO ME that very few refiners will install steam driven pumps to operate a Cracking Plant, when the Cracking Plant itself provides gas which can be used for operating gas engine driven pumps at much less cost than by using steam." So says Mr. L. D. Fulton, Superintendent of The Pennzoil Company, one of the largest refining companies in Pennsylvania.

The illustration shows the TRANSIT Gas Engine Driven Hot Oil Pump at the refinery of The Pennzoil Company, Oil City, Pennsylvania. The Gas Engine is a TRANSIT 17x24" Twin tandem, four-cycle, single acting engine operating on refinery gas. It is rated at 310 H.P.

The engine is direct connected through backgearing to a TRANSIT 5x24" Horizontal Duplex Plunger Hot Oil Pump with forged steel fluid cylinders and extra deep stuffing boxes.

The pump has a capacity of 350 GPM of hot oil at its normal rating of 45½ RPM. It is equipped with 3⅝" diameter reversible valves and designed to operate on 600°F. oil.

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The People Are Not Helpless

The new Secretary of the Interior who summoned the oil conference which was opened at Washington Monday struck the keynote of the occasion when he declared:

"But it is by no means certain that the people of the United States are helpless to prevent the reckless dissipation of an indispensable natural resource."

This is the point that needed to be remembered by all parties to the conference and being emphasized by Mr. Ickes in his opening statement can be accepted as representing the view of President Roosevelt who can be expected to put the case to the people if the situation requires it.

Secretary Ickes had already stated that "stability in this industry is important to the whole business structure". An administration which has not only pledged itself but is actually doing all it can to restore the business structure recognizes the importance of the oil industry as a focal point.

The comparatively slight shrinkage in demand for its products should make it the easier to start the oil business forward again if the handicaps which are holding it back could be removed.

Secretary Ickes shows that the administration has a thorough knowledge of what these handicaps are and what the remedies must be.

The oil industry asks no loan, dole or special privilege from government. Instead its earnings are a principal support of government. All it seeks is protection in legitimate operations from racketeering methods.

Primarily the production of oil must be held to the maximum demand which is 2,000,000 barrels a day and no more.

Three states produce over four-fifths of the oil—Texas, California and Oklahoma. There has been tacit recognition of the approximate proportions which each state should produce so that there should not be any quarrel over that point.

The difficulty has been to keep those proportions within the total of market demand. Certain operators in each state have persisted in producing more than their allowable and the failure of state enforcement has allowed them to get away with it.

This brings the issue squarely to the point stressed by Mr. Ickes that the people must take a hand in protecting their own interests.

Since they had failed to get satisfactory action from the states they turn to Washington.

Neither the people nor the national administration is going to stand by and see returning prosperity blocked by the selfish obstruction of a handful of racketeers and politicians.

This great industry whose stability is so important to the whole business structure cannot be left at the mercy of a few profiteers who undermine the constructive work of all the rest of the industry.

They have been tolerated so long because of lack of decisiveness in dealing with them. The industry has felt hampered by legal doubts and difficulties, largely removed by the Appalachian Coals decision.

The politicians have jigsawed the regulations and enforcement into seemingly endless confusion.

But now the whole business has been forced into the light of day at Washington with the assurance of pitiless analysis before the whole people.

Barring illegally produced oil from interstate commerce would deprive violators of most of their market—in Texas 75 per cent of the production is sold outside the state and in Oklahoma 60 per cent is shipped beyond the state boundary.

Enforcement of this provision, however, must depend upon valid and explicit state regulation so there can be no quibble about what production is illegal and what is legal.

The states which have played with proration so long must come to time. They have put themselves on record as favoring the principle. Now they must put it into practice.

With valid and honest enforcement regulations in the states and a Federal ban on interstate transportation of illegally produced oil it should be a simple matter to reach an agreement within the industry that production should not exceed the market demand.

Stability in crude oil supply would soon wipe out the gasoline tax evasion racket which has thriven on illegally produced oil and the whole industry would have a chance to obtain a fair minimum price for both crude and products.

The ill-gotten gains from illegally produced oil are obtained at the expense of everybody in the industry, everybody who does business with it and the taxpayers and states who secure revenue from it.

The demoralization of the oil industry, despite its well maintained market, demands remedial action. It is of national consequence.

An oil industry steadied and assured would be an aid and encouragement to industry and business all over the country, an aid because of its actual buying power and an encouragement because it had found an answer to the problem of the day, overproduction and broken down markets.

The public has everything to gain by stabilized industry—where production and demand meet at a fair price. It has all to lose where production in excess of demand causes sale below cost with resulting shutdowns and unemployment, loss in tax revenue, deficits and higher taxation.

The world is moving fast today. Old ideas that would not work are being cast aside and we are ready for new ones that will work. We are learning that some of the shibboleths of so-called conservatism were merely coverings for selfish purposes.

The oil industry tried rugged individualism—the devil take the hindmost, get all you can when you can—until Seminole and Oklahoma City and then East Texas showed the folly of it.

We feared regulation—and some of the regulation we have had justified that fear—but there can be honest regulation with the common good in view and it should not be impossible to attain it.

The conference at Washington justifies that hope—if put before the country with the active and energetic support of the president.

The people are not helpless. No paltry selfish interests are going to be allowed to block the general progress.

The country has confidence that President Roosevelt will see that a workable plan comes out of this conference.

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REPAIR

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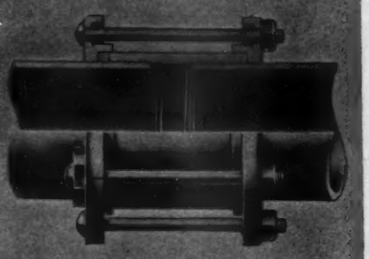
DRESSER COLLAR LEAK CLAMP



STYLE 4½-H.P.
DRESSER BELL JOINT CLAMP

STYLE 41 Clamps prevent or permanently repair leaks at ends of screw collars on steel pipe, size 4½-inch and up. (Smaller pipe takes Style 4 Clamps of same design.)

STYLE 4½-HP Clamps repair leaking lead or other bell-and-spigot cast-iron pipe joints, or reinforce and supplement joints of that type.

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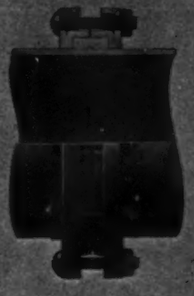
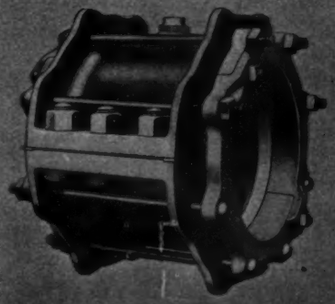


STYLE 52
DRESSER CAST SPLIT SLEEVE



REFINERY AND CRUDE PRICES

Quotations on refined products are for interstate or export movement except as otherwise noted

EXCLUSIVE OF TAXES

The following quotations are exclusive of the Federal excise taxes of 1 cent a gallon on gasoline and 4 cents on lubricating oils, which became effective June 21, 1932.

Refinery Gasolines

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
*U. S. Motor grades:				
Regular	.02¼	.02½	.02⅝	.02½
Premium	.02½	.02¾	.02⅝	.02¾
Third grade	.02	.02¼	.02⅛	.02¼
60-62 400 grades:				
Regular	.02⅝		.02½	
Premium	.02⅝		.02¾	
Third grade	.02⅛		.02¼	
64-66 390	.02¼	.02½	.02⅝	.02½
64-66 375	.02⅝	.02⅝	.02½	.02¾
68-70 350	.02⅝	.02⅞	.02¾	.03
NORTH TEXAS—				
U. S. Motor grades:				
Regular	.02¼	.02⅝	.02¼	.02½
Premium	.02½	.02¾	.02½	.02¾
Third grade	.02	.02¼	.02	.02¼
60-62 400	.02½	.02¼	.02½	.02¼
64-66 390	.02¼	.02½	.02¼	.02¼
64-66 375	.02½	.02¾	.02½	.02¾
64-66 360	.02⅝	.02⅞	.02¾	.03
†NORTH LOUISIANA—				
U. S. Motor grades:				
Regular	.02¾		.02¾	
Premium	.03		.03	
Third grade	.02½		.02½	
60-62 40	.02⅝	.02¾	.02⅝	
†ARKANSAS—				
U. S. Motor grades:				
Regular	.02⅝		.02⅝	
Premium	.02¾	.03	.02¾	.03
Third grade	.02⅝	.02½	.02⅝	.02½
CHICAGO (Based on Oklahoma Group 3)—				
U. S. Motor grades:				
Regular	.02¼	.02½	.02¼	.02½
Premium	.02½	.02⅝	.02½	.02⅝
Third grade	.02	.02¼	.02	.02¼
60-62 400	.02½	.02¼	.02½	.02¼
64-66 375	.02⅝	.02⅝	.02⅝	.02⅝
68-70 360	.02⅝	.02⅞	.02⅝	.03
Aviation fighting grade	.03⅛	.03⅜	.03⅛	.03⅜

*Octane Ratings—The following octane ratings apply to the three grades of U. S. Motor gasoline: Regular, 57-65 octane number; premium, above 65 octane number; third grade, below 57 octane number.

†For Arkansas, Louisiana and Mississippi delivery.

PENNSYLVANIA (inland refineries)—				
U. S. Motor	.04½	.04¾	.04½	.04¾
60-62 400	.04⅝	.04¾	.04⅝	.04¾
64-66 375	.05	.05¼	.05	.05¼
68-70 350	.05¼	.05½	.05¼	.05½
CHICAGO (Based on Oklahoma Group 3)—				
54-58 U. S. Motor	.04	.05	.04	.05
58-60 400	.04¾	.05¾	.04¾	.05¾
EAST COAST—				
U. S. Motor, below 65 octane:				
New York (Bayonne)	.04⅜		.04⅜	
Boston	.04⅝		.04⅝	
Baltimore	.04⅝		.04¾	
Charleston, S. C.	.05¼		.05	
U. S. Motor, 65 octane and above:				
New York (Bayonne)	.05		.05	
Boston	.05		.05	
Baltimore, Md.	.05		.05	
Charleston, S. C.	.05¼		.05¼	
GULF COAST (domestic)—				
U. S. Motor, 65 octane and above	.03¾	.04	.03¾	.04
U. S. Motor, below 65 octane number	.03	.03¼	.03	.03¼

Naphthas

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
50-52 450 (blending)	.02⅛	.02¼	.02⅛	.02¼
PENNSYLVANIA (inland refineries)—				
50-54 430-450 (blending)	.04¼	.04⅝	.04¼	.04⅝
†ARKANSAS—				
48-50 (blending)	.02¼	.02½	.02¼	.02½
CHICAGO (Based on Oklahoma Group 3)—				
50-52 450 (blending)	.02	.02¼	.02	.02¼
Cleaners' naphtha, 56-58 gr., 200 i.b.p.-320 e.p.	.05¼	.05½	.05	.05¼
Lacquer diluent, 180 i.b.p.-250 e.p.	.06½	.06¾	.06½	.06¾
Lacquer diluent, 140 i.b.p.-200 e.p.	.07½	.08	.07½	.08
Rubber solvent, 68-70 gr., 100 i.b.p.-300 e.p.	.05¼	.05½	.05	.05¼
Stoddard solvent, 300 i.b.p.-410 e.p., over 100° flash	.04¾	.05	.04¾	.05
Pet. thinner, 290, 300 i.b.p.-415 e.p., over 83° flash	.04	.04¼	.04	.04¼
V.M.&P. naphtha, 56-58 gr., 190-200 i.b.p.-390 e.p.	.05	.05¼	.05	.05¼
Petrolem spirits	.03⅞	.04	.03¾	.04

Natural Gasolines

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
Grade 18-55	.01¾	.01⅞	.02⅛	.02¼
Grade 26-70	.01⅜	.01½	.01⅝	.01⅝
Grade 30-70	.01⅜		.01⅝	
*Low pressure grades:				
15 lb. v.p. (max.)	.02⅛	.02¼	.02¼	.02⅜
11 lb. v.p. (max.)	.02⅜	.02½	.02½	
NORTH TEXAS—				
Grade 18-55	.01¾		.02¼	.02¼
Grade 26-70	.01⅜		.01⅝	.01⅝
Grade 30-70	.01⅜		.01⅝	
*Low vapor pressure grades:				
15 lb. v.p. (max.)	.02⅛	.02¼	.02¼	
11 lb. v.p. (max.)	.02⅜	.02½	.02½	
NORTH LOUISIANA—				
Grade 26-70	.01⅝	.01¾	.01⅞	.02
CALIFORNIA—				
75-78 375	.03½	.04	.03½	.04

Kerosenes

(All kerosenes water white)

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
41-43	.02¼	.02½	.02¼	.02½
42-44	.02⅜	.02⅝	.02⅜	.02⅝
NORTH TEXAS—				
40-41	.02½	.02½	.02	.02½
41-43	.02¼	.02⅜	.02⅛	.02¼
†NORTH LOUISIANA—				
41-43	.03	.03¼	.03	.03¼
42-44	.03¼		.03¼	
†ARKANSAS—				
41-43	.03	.03¼	.03	.03¼
PENNSYLVANIA (inland refineries)—				
45	.04½	.04¾	.04½	.04¾
46	.04½	.04¾	.04½	.04¾
47	.04¾	.05	.04¾	.05
CHICAGO (Based on Oklahoma Group 3)—				
41-43	.02¼	.02½	.02¼	.02½
42-44	.02⅜	.02⅝	.02⅜	.02⅝
*CALIFORNIA—				
38-40 high burning test	.03½	.04½	.03½	.04½
NEW YORK (Bayonne, N. J.)—				
41-43	.05¼		.05¼	
GULF COAST (domestic)—				
41-43 water white	.04¼	.04½	.04¼	.04½

*For Pacific Coast consumption.

†For Arkansas, Louisiana and Mississippi delivery.

Furnace Oils and Tractor Fuels

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
32-36 straw	.01⅞	.02⅛	.01⅞	.02⅛
36-38 straw	.01¾	.01⅞	.01¾	.02
38-40 straw	.01¾	.01⅞	.01¾	.02
39-41 prime	.01¾	.02	.01⅞	.02⅛
NORTH TEXAS—				
38-40 straw	.01¾	.01⅞	.01¾	.02
†NORTH LOUISIANA—				
36-40	.02½	.02¾	.02½	.02¾
†ARKANSAS—				
32-36	.02½	.02⅝	.02½	.02⅝
CHICAGO (Based on Oklahoma Group 3)—				
32-36 straw	.01⅞	.02	.02	.02⅛
38-40 straw	.01¾	.01⅞	.01¾	.01⅞
38-40 prime white	.01⅞	.02	.01⅞	.02
PENNSYLVANIA (inland refineries)—				
40-41 prime white	.03¼	.03½	.03¼	.03½
NEW YORK (Bayonne, N. J.)—				
32-36	.04		.04	
36-40	.05		.05	
21 (industrial)	.03½		.03½	

Above prices are for distillate oils of zero cold test under 190° F. flash and good odor.

†For Arkansas, Louisiana and Mississippi delivery.

Gas Oil, Diesel Oil and Fuel Oil

Gas oil (G.O.) quoted per gallon basis; Diesel oil and fuel oil per barrel.

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
32-36 (G.O.) cracking stock	.00⅞	.01¼	.01	.01¼
U.G.I. (G.O.)	.00⅞	.01⅛	.01	.01¼
32-36 zero to 15 (G.O.) high flash	.01⅜	.01½	.01⅝	.01½
28-30, zero to 10	.65	.75	.70	.80
26-30, zero to 10	.55	.65	.60	.65
24-26	.35	.40	.40	.45
20-22	.32½	.35	.35	.40
Below 16	.30	.35	.32½	.37½
NORTH TEXAS—				
32-36 (G.O.) industrial	.00⅞	.01	.01	.01⅛
22-26	.35	.40	.35	.40
Below 20	.30	.35	.30	.35
†NORTH LOUISIANA—				
32-36 (G.O.) zero	.02½		.02½	
14-16	.30	.35	.35	
†ARKANSAS—				
30-32 (G.O.) zero	.02¼	.02½	.02½	
14-16	.30	.35	.35	
CHICAGO (Based on Oklahoma Group 3)—				
32-36 (G.O.) industrial	.01	.01⅛	.01	.01¼
28-30 (zero)	.70	.75	.75	.80
26-28 (zero)	.60	.65	.62½	.67½
22-26 (zero)	.47½	.52½	.50	.55
18-22 (zero)	.42½	.45	.42½	.45
Below 18	.37½	.40	.40	.45
PENNSYLVANIA (inland refineries)—				
36-40	.03		.03	

Note: Fuel oils of more than 40 cold test generally 5 to 10 cents per barrel less in all areas than shown in above tables.

†For Arkansas, Louisiana and Mississippi delivery.

CALIFORNIA—				
30-34 (G.O.) per bbl.	.80	.90	.80	.90
27 plus Diesel	.80	.90	.80	.90
15-19 bunker (at tidewater)	.50	.60	.50	.60
15-19 (cargo lots)	.45	.55	.45	.55
15-19 (tank cars)	.35	.45	.35	.50
GULF COAST—				
28-30 (G.O.)	.03	.03¼	.03	.03¼
28-30 Diesel	1.50		1.50	
Bunker C (bulk cargoes)	.50		.50	
Bunker C (bunkers)	.60		.60	
NEW YORK (Bayonne, N. J.)—				
28 plus (G.O.)	.04		.04	
*28-30 Diesel	1.65		1.65	
26-30 Diesel (tank cars)	.04		.04	
†Bunker C	.75		.75	

*Lighterage 6½ cents per barrel.

†Lighterage 5 cents per barrel.

Petroleum Coke*

Prices per ton f.o.b. refineries in Chicago area.

Breeze (screenings)	4.50	4.50
Still runs	5.50	5.50
Lump and egg	6.50	6.50

*Refineries will absorb freight to 80 cents a ton.

Neutral Oils

(Viscosity at 100° F. and color)

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
Zero to 10 Cold Test:				
150-3	.06½	.06½	.06¼	.06½
180-3	.07½	.07¾	.07½	.07¾
180-4	.07	.07¼	.07	.07¼
200-3	.08	.08¼	.08	.08¼
200-4	.07¾	.08	.07¾	.08
240-3	.10	.10¼	.10	.10¼
240-4	.09¾	.10	.09¾	.10
280-3	.11	.11¼	.11	.11¼
280-4	.10½	.10¾	.10½	.10¾
300-3½	.11¼	.11½	.11¼	.11½
350-3½	.11¾	.12	.11¾	.12
400-4	.12¼	.12½	.12¼	.12½
500-4½	.13	.13¼	.13	.13¼
100-2 paraffin oil	.04¼	.04½	.04¼	.04½
15-30 Cold Test:				
200-3	.07¼	.07½	.07¼	.07½
200-4	.07	.07¼	.07	.07¼
240-3	.09¼	.09½	.09¼	.09½
240-4	.09	.09¼	.09	.09¼
280-3	.10¼	.10½	.10¼	.10½
280-4	.10	.10¼	.10	.10¼
PENNSYLVANIA—				
150 vis., No. 3, 400-405:				
Zero pour test	.11	.11½	.11	.11½
10 pour test	.10¾	.11	.10¾	.11
15 pour test	.08¾	.09¼	.08¾	.09¼
25 pour test	.08	.08¼	.08	.08¼
180 vis., No. 3, 25 pour test	.10¾	.11¼	.10¾	.11¼
200 vis., No. 3:				
Zero pour test	.15	.15½	.15	.15½
10 pour test	.14¼	.14¾	.14¼	.14¾
15 pour test	.13	.13½	.13	.13½
25 pour test	.12½	.12¾	.12½	.12¾

GULF COAST—				
Pale Oils:				
100-2-2½	.05¼	.05½	.05¼	.05½
200-3	.06½		.06½	
300-3	.07¼	.07½	.07¼	.07½
500-3½	.09¼	.09½	.09¼	.09½
750-3½	.10¼	.10½	.10¼	.10½
1,200-3½	.12½		.12½	
2,000-4	.13½	.14	.13½	.14
Red Oils:				
200-5-6	.05¼	.05½	.05¼	.05½
300-5-6	.06½	.06¾	.06½	.06¾
500-5-6	.07½	.07¾	.07½	.07¾
1,200-5-6	.10½	.11	.10½	.11
2,000-6 plus	.12¼	.12½	.12¼	.12½
CALIFORNIA—				
Pale Oils:				
100-2½-3	.09	.10	.09	.10
200-2½-3	.10	.11	.10	.11
300-3-3½	.11	.11½	.11	.11½
350-3-4	.11½	.11¾	.11½	.11¾
400-3-4	.11¾	.12	.11¾	.12
450-3-4	.12	.12¼	.12	.12¼
550-3-4	.12¼	.12¾	.12¼	.12¾
Red Oils:				
200-4-5	.08¾	.09¾	.08¾	.09¾
300-5-6	.10	.10½	.10	.10½
350-5-6	.10½	.11	.10½	.11
400-5-6	.11	.11½	.11	.11½
450-5-6	.11½	.11¾	.11½	.11¾
500-5-6	.11¾	.12	.11¾	.12
600-5-6½	.12	.12¼	.12	.12¼
700-6½ plus	.12¼	.12½	.12¼	.12½
750-6½ plus	.12½	.12¾	.12½	.12¾
900-6½ plus	.13	.14½	.13	.14½

Bright and Steam Refined Stocks

OKLAHOMA (Group 3)—	Mar. 28		Mar. 21	
630 light green	.06	.07	.06	.07
600 light green S.R.	.04	.05	.04	.05
600 dark green S.R.	.03	.04	.03	.04
Bright Stocks:				
190-200 D	.14	.15	.14½	.15¼
150-160 D, 0-10	.13		.13½	
150-160 D, 10-25	.12¼		.12¾	
150-160 D, 25-40	.11¾		.12¼	
150-160 E	.11¾		.12¼	
PENNSYLVANIA—				
600 S.R.	.07¾	.08	.07¾	.08
650 S.R.	.10¾	.11¼	.10¾	.11¼
600 Pennsylvania flash	.11¾	.12¼	.11¾	.12¼
630 D filtered	.16¾	.17¼	.16¾	.17¼
600 E filtered	.12¼	.12¾	.12¼	.12¾
Pennsylvania Grade bright stock: Bright Stock, No. 8 color, 145-50 vis. 210-540-550 flash:				
10 pour test	.18½	.19	.19½	.20½
15 pour test	.16½	.17	.17½	.18½
25 pour test	.15½	.16	.16½	.17

Wax and Petrolatum

(Prices per pound)

	Mar. 28		Mar. 21	
OKLAHOMA (Group 3)—				
124-126 white crude scale	.01⅝	.01¾	.01⅝	.01¾
PENNSYLVANIA—				
122-124	.02		.02	
124-126	.02⅛	.02¼	.02⅛	.02¼
NEW YORK (Bayonne, N. J.)—				
120-122	.02½		.02½	
125-127	.02¾		.02¾	
130-132	.03⅛		.03⅛	
133-135	.04		.04	
135-137	.04⅛		.04⅛	
Petrolatum in barrels in carload lots:				
Dark green	.01⅞		.01⅞	
Amber	.02		.02	
Extra amber	.02⅜		.02⅜	
Lily white	.05½		.05½	
Snow white	.06½		.06½	
Cream	.04½		.04½	

Export Prices

GASOLINE				
GULF COAST—	Mar. 28		Mar. 21	
U. S. Motor	.03⅜	.03½	.03⅜	.03½
60-62 400	.03⅝		.03⅝	
61-63 390	.03⅝		.03⅝	
64-66 375	.03⅝	.03¾	.03⅝	.03¾
LOS ANGELES, CALIF.—				
U. S. Motor, 53-55 437 e.p.	.03¾	.04¼	.03¾	.04¼
U. S. Motor, 65 octane num.	.04½	.04¾	.04½	.04¾
U. S. Motor, 67 octane num.	.05		.05	
U. S. Motor, 69 octane num.	.05¼		.05¼	
58-60 400 endpoint gasoline	.04¼	.05	.04¼	.05
KEROSENE				
GULF COAST—				
41-43 prime white	.04		.04	
41 water white	.04⅛	.04¼	.04⅛	.04¼
LOS ANGELES, CALIF.—				
41-43 water white	.03¾	.04¼	.03¾	.04¼
LUBRICANTS				
NEW YORK, (f.a.s. in bbls.)—				
600 Warren E	.18		.18	
600 S.R. unfiltered	.14	.15	.14	.15
650 S.R. unfiltered	.16½		.16½	
600 flash S.R.	.18		.18	
630 flash S.R.	.23		.23	
Bright stock, No. 8 color	.23½		.23½	
Bright stock, No. 6½ color, dil.	.22½		.22½	
NEUTRALS				
NEW YORK—Pale Engine Oil, Bulk (vis. at 100)—				
230-3¾	.09¾		.09¾	
180-3¼	.09½		.09½	
100-2¼	.05		.05	
Red Engine Oil, Bulk (vis. at 100):				
300-6½	.09½		.09½	
250-6	.08½		.08½	
200-6	.07¾		.07¾	

Crude Oil Prices

Oklahoma, Kansas, North and East Central Texas

East Texas (see note) ..... $ .50
Corsicana, heavy (Jan. 20, 1933)* ..... .30
Other fields ..... See gravity table

East Texas posted by Tide Water Oil Co., January 18; Sinclair Prairie Oil Marketing Co., January 18; The Texas Company, January 20; Magnolia Petroleum Co., January 20; Shell Petroleum Corp., January 19; Panola Pipe Line Co., January 20; Humble Oil & Refining Co., January 20.
*Magnolia Petroleum Co.

West Texas

Iatan and Westbrook .. Same as North Texas
Crane, Upton, Crockett, Howard, Glasscock, Mitchell, Ector, Winkler and Pecos Counties ..... See note below
Lea County, N. Mex. ..... See Rocky Mountain table
Toborg, Pecos County* ..... $ .40
Jones and Fisher Counties ..... See gravity table

Note—Crane, Upton, etc., effective January 19 by The Texas Company, 30 cents; followed by Humble Oil & Refining Co., Magnolia Petroleum Co., Gulf Pipe Line Co., on January 20, and by other purchasers.
*Shell Petroleum Corp., January 19, 1933.

Texas Panhandle

Gray County, Wheeler County and Carson-Hutchinson Counties ..... See gravity table

Gulf Coast

Grade A and Grade B specifications discontinued by leading buyers ..... See gravity table
Jennings, La. (Jan. 20, 1933)* ..... $ .35
Cameron Meadows, La. (Jan. 20, 1933)† ..... Below 20 gravity 22 cents, differential 2 cents per degree beginning with 21-21.9 at 24 cents with 40 gravity and over at 52 cents.
Refugio, light ..... See gravity table
Refugio, heavy (Jan. 20, 1933)‡ ..... .45
Markham‖ .. See Gulf Coast gravity schedule
High Island‖ ..... See Gulf Coast gravity schedule
Conroe ..... See note

*Gulf Refining Co. †Magnolia Petroleum Co. ‡Humble Oil & Refining Co. ‖The Texas Company. †Yount Lee Pipe Line Co.
Note—In the Conroe Field, effective January 19, Tide Water Oil Co. posted as follows: 35-35.9 degrees, 59 cents, with 1 cent added for each degree upward to 40 degrees and over, at 64 cents; January 20, Humble Oil & Refining Co. posted 35-35.9 degrees, 54 cents, with 2 cents added for each degree upward to 40 degrees and over at 64 cents. The Texas Company met Humble Oil & Refining Co. prices on March 6.

South Central and Southwest Texas

Darst Creek ..... See note below
Luling (Jan. 20, 1933) ..... $ .30
Miranda (Jan. 20, 1933) ..... .35
Pettus (Jan. 20, 1933) ..... .55
Salt Flat (Jan. 20, 1933) ..... .40
Lytton Springs (Jan. 20, 1933) ..... .45
Duval County (March 6, 1933) ..... .35
Saxet (March 6, 1933) ..... .45

Note—The Texas Company, January 19, followed by Humble Oil & Refining Co., Magnolia Petroleum Co. and Gulf Pipe Line Co., January 20. Magnolia Petroleum Co. in Luling; Magnolia, Humble and Gulf companies in Refugio crude; Humble and Gulf companies in Pettus; Humble and Gulf companies in Salt Flat; Magnolia Petroleum Co. in Lytton Springs. In Darst Creek, effective January 19, The Texas Company, 35 cents; effective January 20, Magnolia Petroleum Co., 35 cents; Humble Oil & Refining Co., 40 cents; Gulf Pipe Line Co., 40 cents. Duval and Saxet posted by The Texas Company.

North Louisiana and Arkansas

Smackover, Ark. (all grades) ..... See note below
Urania, La. (Jan. 20, 1933) ..... $ .25
East El Dorado, Ark. (Jan. 20, 1933) ..... See note below
Other fields ..... See gravity table

Note—Smackover, all grades, effective January 19 by The Texas Company, 30 cents; January 20, Standard Oil Co. of Louisiana, 20 cents, Magnolia Petroleum Co. 20 cents, Gulf Refining Co. 30 cents; Louisiana Oil Refining Corp., 25 cents. Urania Field posted by Louisiana Oil Refining Co. and H. L. Hunt, Inc., East El Dorado, effective January 20, Magnolia Petroleum Co. 20 cents, Gulf Refining Co. 30 cents.

Eastern States

JOSEPH SEEP PURCHASING AGENCY
(Effective January 21, 1933)

Pennsylvania Grade Oil in National Transit Lines (Bradford Field) $1.47
Pennsylvania Grade Oil in Southwest Pennsylvania Lines 1.17
Penna. Grade Oil in Eureka Pipe Line Lines 1.12
Penna Grade Oil in Buckeye Pipe Line Lines ..... .97
Corning Grade Oil in Buckeye Pipe Line Co.'s line (Jan. 20, 1933) ..... .70
Ragland Grade Oil in Cumberland Pipe Lines (Kentucky) (Jan. 10, 1931) ... .60

PENNZOIL CO.
(Effective January 21, 1933)

Pennsylvania Grade Oil in National Transit Lines:
Group A $1.42
Includes Cochran, Franklin, Hamilton and Doolittle districts.
Group B 1.41
Includes Titusville district.
Group C 1.40
Includes Turkey and Tidioute districts.
Group D 1.39
Includes Bear Creek and Porkey districts.
Group E 1.37
Includes Eldenau, Bull Creek, Rough Run, Carbon, Dipner, Bredin, McJunkin, Jamison, Kennerdell, Emlenton, Tiona, Lacy and Kinsua districts.
Price depends on length of pipe line haul to plant at Oil City.

TIDE WATER PIPE CO.
(Effective January 21, 1933)

Bradford, Pa. $1.47
Allegany, N. Y. 1.47

PURE OIL CO.
(Effective January 21, 1933)

Cabin Creek, W. Va. $1.12
Bradford Hollow, W. Va. 1.12
Kelly's Creek, W. Va. 1.12

Rocky Mountain States

OHIO OIL CO.-STANOLIND OIL & GAS CO.
Ilea, light (Jan. 18, 1933) ..... $ .40
Ilea, heavy (Jan. 18, 1933) ..... .34

(Continued on Page 29)

Crude Oil Gravity Table

Degrees of gravity—	1 Kansas, Oklahoma, North Texas, Central Texas, East Central Texas	2 North Louisiana and Arkansas	3 North Louisiana and Arkansas	4 Gray County, Texas	5 Carson, Hutchinson and Moore Counties, Texas	6 Gulf Coast, Texas and Louisiana	7 Gulf Coast, Texas and Louisiana	8 Salt Creek, Wyoming
Below 20	....	....	....	....	....	$.45	$.32	....
20-20.9	....	....	....	....	....	.45	.34	....
21-21.9	....	....	....	....	....	.45	.36	....
22-22.9	....	....	....	....	....	.46	.38	....
23-23.9	....	....	....	....	....	.47	.40	....
24-24.9	....	....	....	....	....	.48	.42	....
Below 25	....	....	....	....	....	....	....	....
25-25.9	....	....	....	....	....	.49	.44	....
26-26.9	....	....	....	....	....	.50	.46	....
27-27.9	....	....	....	....	....	.51	.48	....
28-28.9	....	....	....	....	....	.52	.50	....
Below 29	$.28	$.28	$.20	....	....	....	....	$.28
29-29.9	.30	.30	.22	....	....	.53	.52	.30
30-30.9	.32	.32	.24	....	....	.54	.54	.32
31-31.9	.34	.34	.26	....	....	.55	.56	.34
32-32.9	.36	.36	.28	....	....	.56	.58	.36
33-33.9	.38	.38	.30	....	....	.57	.60	.38
34-34.9	.40	.40	.32	....	....	.58	.62	.40
35-35.9	.42	.42	.34	$.30	$.20	.59	.62	.42
36-36.9	.44	.44	.36	.32	.22	.60	.62	.44
37-37.9	.46	.46	.38	.34	.24	.61	.62	.46
38-38.9	.48	.48	.40	.36	.26	.62	.62	.48
39-39.9	.50	*.50	.42	.38	.28	.63	.62	.50
40 and over	.52	.52	.44	.40	.30	.64	.62	.52

Note—Effective January 20, the Standard Oil Co. of Louisiana posted the following prices in North Louisiana and Arkansas: Caddo, below 29 gravity, 20 cents; 40 gravity and above, 44 cents. Sabine and De Soto, below 29 gravity, 25 cents; 40 gravity and above, 49 cents. Homer, below 29 gravity, 28 cents; 40 gravity and above, 52 cents. Sarepta and Cartersville, below 29 gravity, 17 cents; 40 gravity and above, 41 cents. El Dorado, below 29 gravity, 25 cents; 40 gravity and above, 49 cents. Haynesville, below 29 gravity, 19 cents; 40 gravity and above, 43 cents. The above all carry 2 cents differential for each degree in gravity. Smackover, all grades, 20 cents.

Column 1—Effective January 18, Stanolind Crude Oil Purchasing Co., Sinclair Prairie Oil Marketing Co.; January 19, The Texas Company; January 20, Magnolia Petroleum Co. (starting at below 25 degrees, 20 cents, with 2 cents added for each degree upward); January 20, Carter Oil Co. in Oklahoma and Kansas and Humble Oil & Refining Co. in North Central and East Central Texas; January 20, Gypsy Oil Co. in Oklahoma and Kansas and Gulf Production Co. in North, Central and East Central Texas; January 18, Globe Oil & Refining Co. and Tide Water Oil Co. in Kansas and Oklahoma; January 19, Empire Pipe Line Co., Shell Petroleum Corp.; January 18, in Oklahoma, Deep Rock Oil & Refining Co., Barnsdall Refineries, Inc., Continental Oil Co., Bell Oil & Gas Co., Tide Water Oil Co., Champlin Refining Co., Anderson-Prichard Corp., Cushing Refining Co., Eason Oil Co., Johnson Oil Refining Co., Mid-Continent Petroleum Corp., Pepper Gasoline Co., Sunray Oil Co., Yale Oil Corp., Twin State Oil Co., Rock Island Refining Co.; January 20, Phillex Oil Co. and Pure Oil Co.; Oklahoma and North Texas, January 18, Continental Oil Co.; Kansas, January 18, Eldorado Refining Co., Vickers Petroleum Co., Skelly Oil Co. (starting below 25 degrees, 20 cents, with 2 cents added for each degree upward); January 19, White Eagle Oil Corp. Effective March 1 Derby Oil & Refining Co. posted in Kansas as follows: Below 29 degrees 28 cents, with 2 cents added for each degree up to 40.9, inclusive, at 52 cents; 41-41.9 degrees, 56 cents; 42 degrees and above, 60 cents. In the Stratman and Stoltenberg Pools, 52 cents flat.

Column 2—The Texas Company, January 19; Louisiana Oil Refining Co., January 20; Gulf Refining Co., January 20 (starting at below 25 degrees, 20 cents, with 2 cents added for each degree upward). For Standard Oil Co. of Louisiana schedule see note below price table.

Column 3—Magnolia Petroleum Co., January 20.

Column 4—Effective February 28, 1933, Humble Oil & Refining Co. Effective January 20, Phil Tex Oil Co. Effective March 6, The Texas Company. March 7, Magnolia Petroleum Co.

Column 5—Effective February 28, 1933, Humble Oil & Refining Co. Effective January 20, Phil Tex Oil Co. Effective February 28, Continental Oil Co. Effective March 6, The Texas Company. March 7 by Magnolia Petroleum Co.

Column 6—Effective March 6, 1933, The Texas Company.

Column 7—The Humble Oil & Refining Co., Gulf Pipe Line Co., Magnolia Petroleum Co., Sun Oil Co., January 20.

Column 8—Stanolind Oil & Gas Co., January 18.

(California Crude Oil Prices on Page 29)

Several Products in Oklahoma Market Move to Lower Price Levels With Demand Slow

By C. O. WILLSON

Failure of any developments of a bullish nature to materialize resulted in scattered price reductions for refinery products in the Oklahoma (Group 3) market over the past week. The trade had hoped that before the start of a new week the efforts being made by representatives of the oil-producing states and oil associations would crystallize to the point where refiners and buyers of refinery products would have some definite indication of what would happen during April, the month which marks the start of the main gasoline consuming period for 1933. As this is written, the solution of the problem of furnishing the necessary basis for improved refinery markets had not made its appearance and refinery prices continued to drift downward when any changes were made.

The weakness centered in the products used as motor fuels. Domestic gasolines in Oklahoma dropped to a low of 2 cents for the third grade U. S. Motor and in competing Mid-Continent areas prices were as low as 1¾ cents from responsible sources of supply. Spot buying continues slow. According to those in touch with the jobbing trade there is considerable potential buying among this class of buyers. It is said that despite the low prices that have prevailed since the first of the year there has been relatively little storing of gasoline for the spring and summer months. Some of the jobbers are interested in buying in excess of current requirements and a few inquiries for delivery over April have been received by refiners and brokers. The uncertainty regarding the crude oil situation, however, tends to hold back actual buying on the part of the jobbers and responsible refiners for the same reason hesitate to consider anything but spot business.

Largely the same situation obtains in the natural gasoline market. Prices for the several grades the first of the week dropped so that they were within one-fourth cent of the all-time low established last summer. With normal conditions there is reason to believe that naturals would have been in a much stronger price situation than they were a year ago. Some weak spots in the market have been taken care of and new outlets established including additional export buying. Due to the unfavorable refinery gasoline market some of the large buying expected for March did not materialize and the outlook for April is not favorable unless conditions change to the point where buyers can justify increased purchases on the basis of blending value. Over the past week most of the inquiries for natural gasoline was confined to the jobbing trade. The low prices now prevailing have again attracted a class of buyers who blend the natural with naphtha or U. S. Motor gasoline, largely for the purpose of reducing the cost of the finished products sold to the consumer. At the same time several manufacturers who have been selling the regular natural gasoline grades of from 18 to 26 pounds vapor pressure are considering the advisability of lowering their vapor pressures and sell a product which requires little or no blending with refinery gasolines. In other words naturals are reaching the price levels where "nuisance value" is the controlling factor, a development which is unfavorable not only to the natural gasoline manufacturers but all producers of motor fuels.

Small Refiners Concerned

Prices on refinery products have dropped to such low levels according to one large spot buyer that even the refiners who have been operating on crude oil purchased under the spot market are becoming alarmed. This buyer believes that due to this fact that any effort to boost prices to profitable levels will have more general support than it has had in the past. Over the greater part of last year when most refiners were endeavoring to establish tank car and retail prices in line with the posted prices for crude oil, they had the competition of a small but well entrenced group who were buying their crude supplies delivered at their plants from 25 to 50 cents per barrel under the posted schedules. These concerns made substantial profits last year while others showed a loss for the year's operations. The buyers who operated with the cheap crude oil usually of the "hot" variety made little effort to maintain refinery prices, their main concern being to secure a larger volume of business.

Conditions over the past few weeks have not been so favorable for these operators. They can still buy crude oil under the posted prices but some of their competitors are playing the same game and outlets for refinery products are not so easy to obtain. Present prices for refinery products do not justify even the low posted prices now prevailing for crude oil so that profits of operators who are

Refined Market Barometer

Several refining centers in the United States reported a strong demand for kerosene and furnace oil distillates over the past week. Cold weather in some of the northern states is causing the demand for furnace oils and other special fuels to hold up better than expected and tank car and retail prices are being maintained in practically all areas. In the case of kerosene the demand reflects the usual spring increase in consumption in the agricultural areas. Developments in the gasoline market were not so favorable. Actual retail consumption appears to be slow for this season of the year and with many refiners anxious to move material, all the price changes reported for the week were downward. Fuel oils and gas oils were weak at interior points. Bright stocks were reduced both in Pennsylvania and Mid-Continent. No change in paraffin wax.

Mid-Continent—Refinery gasoline and natural gasoline prices generally lower in all areas. Fair to strong demand reported for kerosene and distillate. Fuel oil and gas oil slow with little demand for high cold test material. Bright stock prices lower.

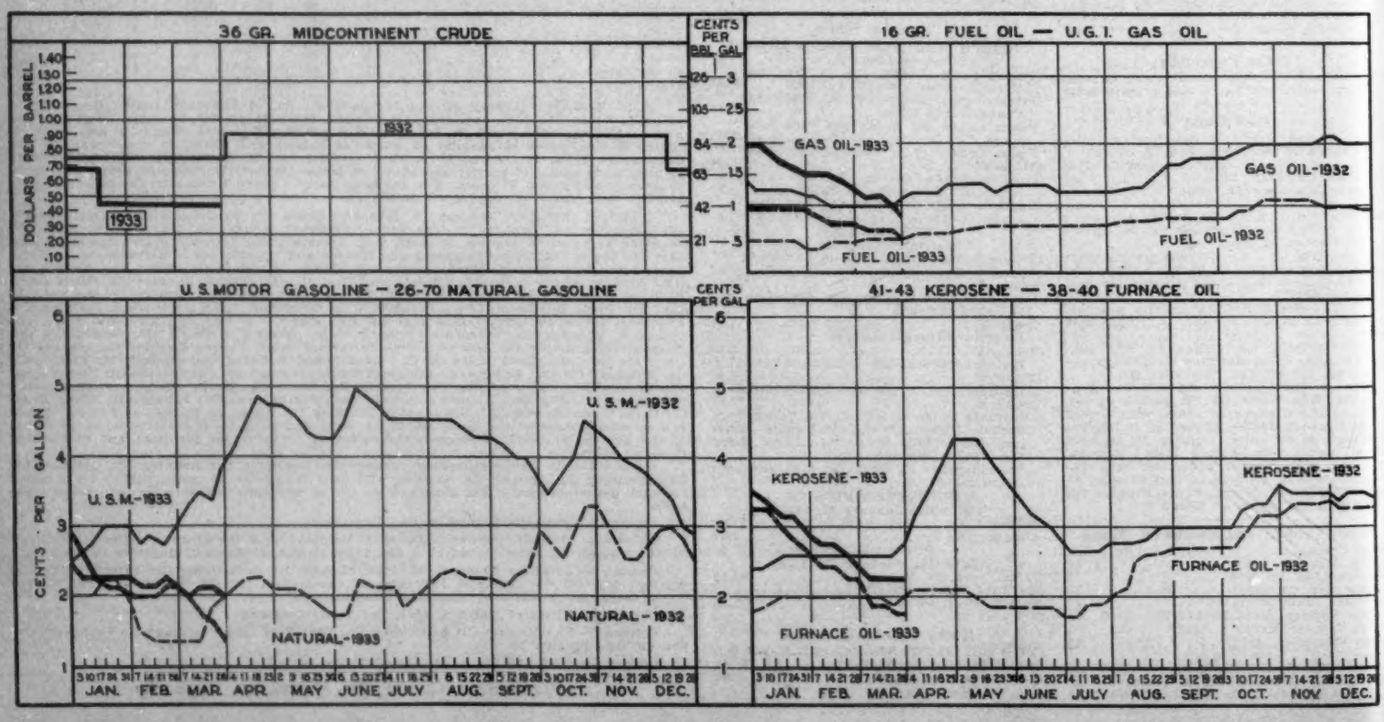
East Coast—Refinery gasoline prices unchanged with slow demand. Good demand for heating oils. Grant concession of 5 cents per barrel in bunker fuel sales in New York Harbor. Diesel gallonage less than normal. More export inquiries for lubricants.

Pennsylvania—Bright stock prices again reduced. Little activity in most grades of neutrals. Gasoline and kerosene unchanged.

Gulf Coast—Kerosene less active. Gasoline and fuel oil dull.

California—No changes in prices. Improved retail demand for gasoline.

Representative Mid-Continent Quotations on Crude Oil and Refined Products Basis Oklahoma (Group 3)



purchasing crude oil under these schedules are nearing the vanishing point.

The situation of many East Texas skimming plant operators is indicative of this condition. Assuming an overhead yield of 50 per cent covering gasoline, kerosene or furnace oil distillate and the operator obtains 21 gallons of refined oils. The average price for this 21 gallons at this time would not be more than 2 cents per gallon or a total of 42 cents per barrel. The remaining 21 gallons is topped crude which in open market sales is now bringing from 5 to 15 cents per barrel f.o.b. East Texas refineries. Thus the total refinery revenue per barrel of crude oil would not exceed 50 cents. Refiners buying crude oil delivered at their plants under 30 cents per barrel can of course still show a profit based on this revenue. However, if present conditions continue in the crude oil end of the business it is practically certain that the posted prices as paid by all buyers will be decreased to 25 cents per barrel or less and it is known that some companies are planning, if all proration programs fail, to pay whatever the going market is, as determined by local refiners. The latter see in this development the end of their advantage in buying cheap oil.

Transportation Main Factor

This will mean if it materializes that transportation costs rather than prices paid for crude oil will be the controlling factor in markets. Obviously in such a development the larger companies which have pipe line and water transportation facilities for the movement of crude oil or refinery products will have the strongest position. The main market factor will not be the tank car price at the small plants in flush fields as has been the case for many months but will be the delivered price at the point of consumption. In pointing out this situation one refinery executive predicts that many major operators with unlimited supplies of crude oil will pursue a policy of refining as much of this crude oil currently as possible and regain some of the jobber and retail business which they have lost over the past two years. While such a program would not mean profitable operations to the larger companies, the plan of increased volume in their transportation and marketing facilities would at least reduce losses and strengthen their sales position when the production of excess crude was ended through the reduction of supplies in flush fields.

The foregoing is the unfavorable outlook which confronts many Mid-Continent refiners including several veteran operators who do not have transportation facilities or the geographical location to compete in a liquidation operation in which the price of crude oil would be a minor factor in the total cost of doing business. The realization of this situation as previously explained has brought some new support to the efforts now being made at Washington, D. C., to bring about a drastic curtailment of crude oil production with a refinery market based on higher prices for crude oil. At the same time there are other operators who are fully aware of the seriousness of uncontrolled production in flush fields as indicated by developments over the past month, but who nevertheless are willing to "take whatever licking is necessary" in the hope that with arbitrary curtailment programs dropped that the crude supplies of flush fields will soon be dissipated and they will then have a firm basis on which to re-establish their business.

Kerosene and Distillate

Kerosene and furnace oil distillate were the only products to display any strength during the week. Price ranges did not advance but in Oklahoma sellers did not have any difficulty in maintaining the quotations in effect a week ago. There was considerable interrefinery buying of kerosene. These buyers are only interested in the best grades of kerosene and do not purchase any of the off-specification material that is available from several plants. Refiners are expecting a continued heavy demand for kerosene over the next 30 days.

The weather in Middle West states has been cold and there continues to be a steady demand for all grades of distillate. Oklahoma refiners have difficulty in meeting the competition of East Texas refiners in the high gravity prime white grades but in the lower gravity, zero material the Texas competition is of minor importance. Prices for the better grades of distillate range from 1⅝ to 2 cents in Oklahoma.

Fuel Oil and Gas Oil

The trend in fuel oil and gas oil prices continues downward. Reports from practically all refinery groups in the Mid-Continent show that there is excess quantities of high cold test material. In Oklahoma sellers of topped crudes were faced with the competition of East Texas material of from 20 to 26 gravity quoted as low as 15 cents per barrel basis Group 3. While this product does not come in direct competition with most of the Oklahoma output of lower cold test it has aided in reducing prices. The best grades of low gravity industrial fuels of medium or low cold test are now available in Oklahoma at a low of 30 cents per barrel.

Bright Stocks Lower

Following a reduction of one-half cent in Pennsylvania market last week Oklahoma manufacturers of bright stocks reduced their prices the same amount. The Oklahoma price in domestic shipments is now 13 cents for 150-160 D zero to 10 and 12¼ cents for the 10 to 25 grade. Paraffin wax prices are unchanged at 1⅝ to 1¾ cents for the 124-126 grade.

Special Naphtha User Requires Products Varying Widely in Specifications

The expanding use of petroleum thinners for paint and varnish has called for a more specialized method of manufacture to meet the paint makers demands.

Following are the specifications for three grades of petroleum naphthas which are representative of one company's purchases:

SPECIFICATIONS FOR A GRADE

Color (Same as standard furnished)	Gardner-Holdt color scale
Specific gravity	.78 to.79 (20° C.)
Flashpoint	Not below 98° F. Tag O.C.
Evaporation	Maximum—30 minutes

Distillation limits—	°F.
Initial	290
10%	310
20%	320
30%	330
40%	335
50%	340
60%	350
70%	360
80%	375
90%	395
95%	400
Endpoint	420

SPECIFICATIONS FOR B GRADE

Color (Same as standard furnished)	Gardner-Holdt color scale
Specific gravity	.775 to .78 (20° C.)
Flashpoint	Above 80° F.
Evaporation	Maximum—10 minutes
Sulphur and its compounds	None

Distillation limits—	°C.
Initial	140
20%	150
50%	160
90%	170
Dry	180

SPECIFICATIONS FOR C GRADE

Color (Same as standard furnished)	Gardner-Holdt color scale
Specific gravity	.724 to .728 (20° C.)
Sulphur and its compounds	None

Distillation limits—	°C.
Initial	85 to 90
20%	100 to 105
50%	107 to 112
80%	Below 135
Endpoint	

Method of Sampling

The total sample shall not be less than 1 gallon and shall be a composite of numerous small samples of not less than 1 pint each, taken from the top, bottom, and intermediate points by means of a glass or metal container, with removable stopper or top. This device is attached to a suitable pole and lowered to the various depths, when the stopper or top is removed and the container allowed to fill.

Color Test

Fill a standard glass viscosity tube (Gardner-Holdt type convenient) with the official liquid sample and a similar tube with the standard sample for comparison. Fill tubes and insert cork to leave same size air-bubble and compare color of sample against standard, both illuminated equally. In case of liquid, which might have attack upon or might be discolored from cork stoppers, the cork should be properly protected by the use of metal foil, wax, or by other suitable means.

Gardner-Holdt Color Scale

The Gardner-Holdt color scale may be conveniently used in some cases to describe the color of the liquid raw material sample. Preferably, a standard sample of the same kind of material should be used for comparison.

Evaporation Test

Place 5 drops of the sample on clean white filter paper and allow to evaporate at room temperature. There should be no spot at the completion of the test.

Sulphur Test

When conducting standard chemical testing method No. 107 (distillation), place a bright, clean strip of copper foil in the distillation flask and allow to remain until the end of the distillation.

If the petroleum naphtha contains dissolved elementary sulphur or corrosive sulphur compounds, the copper strip will be colored gray or black.

American Petroleum Institute Weekly Refinery Statistics

Figures below reported for week by American Petroleum Institute. (1) Per cent refinery capacity represented. (2) Daily average crude runs to stills. (3) Total motor fuel stocks. (4) Gas oil and fuel oil stocks. All figures in 42-gallon barrels.

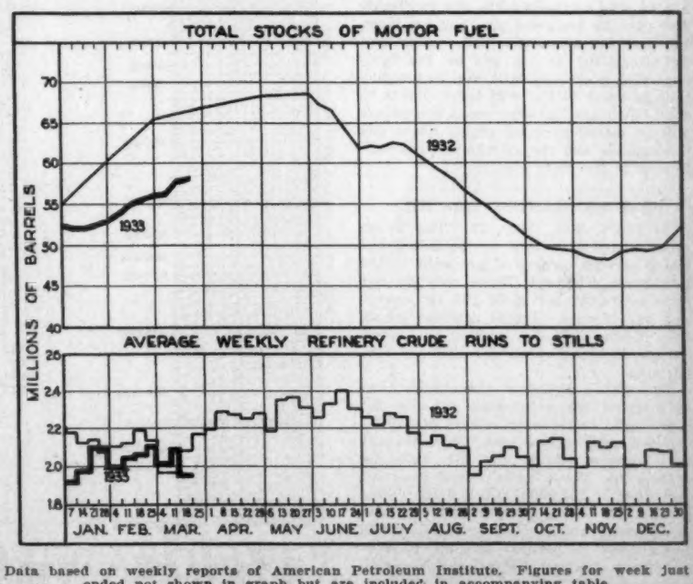
Week Ending March 25, 1933, Compared to Week Ago

	Week ending March 25				Week Ending March 18, 1933			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	99.1	472,000	15,486,000	6,200,000	99.1	448,000	15,200,000	6,326,000
Appalachian	95.0	83,000	2,039,000	820,070	95.0	76,000	1,989,000	824,000
Ind., Ill., Ky.	97.5	293,000	8,494,000	3,394,000	97.5	289,000	8,560,000	3,315,000
Okla., Kans., Mo.	84.9	218,000	5,522,000	2,919,000	84.9	209,000	5,308,000	2,869,000
Inland Texas	56.4	84,000	1,775,000	2,958,000	56.4	85,000	1,674,000	2,128,000
Tex. Gulf	97.7	382,000	6,837,000	5,861,000	97.7	416,000	7,124,000	6,148,000
La. Gulf	97.3	114,000	1,984,000	2,055,000	97.3	114,000	1,925,000	2,193,000
N. La. and Ark.	88.5	36,000	266,000	644,000	87.5	43,000	308,000	660,000
Rocky Mtn.	90.8	25,000	1,569,000	623,000	90.8	31,000	1,572,000	628,000
California	94.6	373,000	14,775,000	98,431,000	94.6	277,000	14,646,000	98,374,000
Total U. S.	91.6	2,085,000	58,747,000	123,005,009	91.6	1,988,000	58,306,000	123,465,000

Total motor fuel stocks Bureau of Mines basis 59,750,000 bbls.

Week Ending March 25, 1933, Compared to Year Ago

	Week ending March 25				Week Ending March 26, 1932			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
East Coast	99.1	472,000	15,486,000	6,200,000	100.0	445,400	6,680,000	5,705,000
Appalachian	95.0	83,000	2,039,000	820,070	91.8	92,000	1,859,000	1,148,000
Ind., Ill., Ky.	97.5	293,000	8,494,000	3,394,000	98.9	303,700	6,369,000	3,986,000
Okla., Kans., Mo.	84.9	218,000	5,522,000	2,919,000	89.6	233,300	4,033,000	2,970,000
Inland Texas	56.4	84,000	1,775,000	2,958,000	....	92,300	1,690,000	2,656,000
Tex. Gulf	97.7	382,000	6,837,000	5,861,000	99.3	360,600	7,504,000	6,355,000
La. Gulf	97.3	114,000	1,984,000	2,055,000	100.0	106,400	1,697,000	3,624,000
N. La. and Ark.	88.5	36,000	266,000	644,000	....	39,500	136,000	654,000
Rocky Mtn.	90.8	25,000	1,569,000	623,000	89.4	33,700	2,049,000	638,000
California	94.6	373,000	14,775,000	98,431,000	97.1	469,100	14,709,000	96,443,000
Total U. S.	91.6	2,085,000	59,747,000	123,005,009	95.2	2,176,000	46,726,000	124,173,000



Data based on weekly reports of American Petroleum Institute. Figures for week just ended not shown in graph but are included in accompanying table

NATURAL GASOLINE MANUFACTURE

Oklahoma House Defeats Bill Taxing Natural Gas

Natural gasoline plant operators in Oklahoma were relieved this week to learn that the new gross production tax bill, in which it was provided that a tax of one-half cent per 1,000 feet of gas produced be paid by the well owner, was defeated in the state house of representatives. Although the tax would be paid by producers, natural gasoline plant operators feared that substantial volumes of gas would be withheld from the market because of the inability of the producer to realize enough from the sale to pay the tax. The immediate effect of such a law would be the shutting down of a number of Oklahoma gasoline plants.

Although the original bill was defeated there is a chance that some form of similar bill will be submitted to the house this week and a committee composed of W. D. Grisso, Seminole County; John M. Holliman, Washington County; Arthur Grunert, Carter County; Thomas Halle, Pittsburg County; T. H. Ottesen, Okfuskee County; James Babb, Le Fores County, and A. D. Jones of Beckham County, has been asked by majority house leader, J. S. Batson, to prepare such a bill.

This committee has been instructed to limit its revised bill to two endeavors, first, to provide for the enforcement of the existing gross production tax law and second, to specify more clearly what individuals, agencies or industries are rightfully exempted in the existing law.

The committee has been asked not to consider any provision for increasing taxes under the present law and hope is expressed that when the new bill is presented, it will not include those provisions that have already been turned down by the house. The limited time for consideration of any bill will call for quick action on the part of the committee and within the present week natural gasoline plant operators will probably know the attitude of the committee.

Stripper well owners, from whom many of the natural gasoline plant operators buy their gas for processing, have been making a strong fight against the proposed tax and it has been due to their efforts that the defeat of the original bill was realized. Knowing that they will not be able to produce the gas profitably and pay the proposed tax they are hopeful that the committee will realize that by attempting to tax gas on the basis suggested previously will stop its production in many fields, will cause plants to shut down and in some cases the plants will be moved to other states where gas is available and the ad valorem tax will be lost to the state also.

PASS PANHANDLE GAS BILL

AUSTIN, Tex., Mar. 27.—The Texas senate voted favorably on the Small bill which permits owners of gas wells in the Panhandle Field of Texas who do not have an outlet for their gas to process this gas through natural gasoline plants and dispose of the residue gas even though it is not used for light or fuel purposes.

The Texas Railroad Commission has been asked for permission to open up other wells in the area and on March 25 received applications from 21 additional well owners asking that 31 wells be opened up. These wells would have an open flow of 337,950,000 feet daily. Other permits have been granted over the past three weeks which collectively will cause an increase in natural gasoline production there of about 150,000 gallons daily when all wells are connected.

Chart Simplifies Design Problem of Pipe Lines in the Natural Gasoline Plants

By W. A. STOVER

The accompanying gas line flow chart is especially adapted to plant design problems where the gas piping consists of short lengths of pipe between the various pieces of equipment constituting the plant, and where the gas temperature at places runs much higher than it usually does in field lines or gas mains. The specific gravity scale reads to 2.5, which makes the chart suitable for determining the size of stabilizer vapor lines or other lines carrying an unusually dense gas.

The chart is constructed from Oliphant's formula which is as follows:

$$Q = 2{,}365a \sqrt{\frac{P_1^2 - P_2^2}{L}} \times \sqrt{\frac{1.0}{G}} \times K$$

Q = Gas flow in cu. ft. per hour.
P_1 = Initial gas pressure lbs./sq. in. absolute.
P_2 = Final gas pressure lbs./sq. in. absolute.
L = Length of line in feet.
a = Constant depending upon size of pipe.
K = Temp. correction factor.
G = Specific gravity of gas (Air=1).

The scale for values of $P_1^2 - P_2^2$ can be multiplied or divided by 10, 100, etc., provided the scale for pipe length values is multiplied or divided by the same factor. If the value of $P_1^2 - P_2^2$ were 20,000, and the pipe length were 1,000 feet, the problem would be solved by dividing 20,000 by 10 = 2,000, and by dividing 1,000 by 10 = 100, to obtain values that are included on the scales.

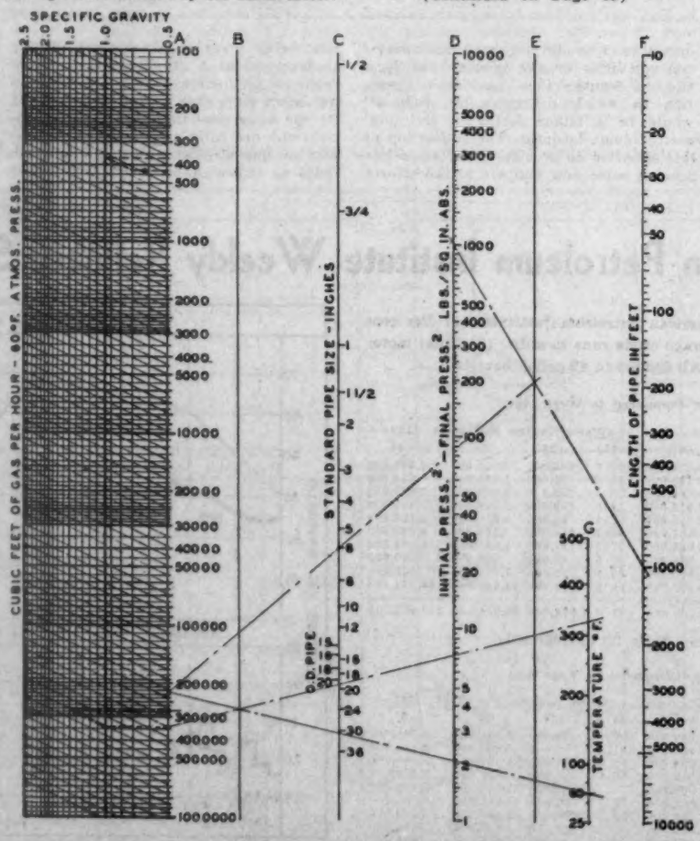
The use of the chart will be explained by the following examples:

Example 1. Find the size line required to carry 275,000 cubic feet of gas per hour for the following conditions:

Sp. gr. of gas (air=1)	1.5
Average temperature of gas, ° F.	325
Length of pipe in feet	1,000
P_1 or initial pressure lbs./sq. in. abs.	55
P_2 or final pressure lbs./sq. in. abs.	45

1. $P_1^2 - P_2^2 = 55^2 - 45^2 = 1{,}000$. 2. Draw a straight line through values on D and F scales. 3. Enter A scale at 275,000 and go horizontally to sp. gr. line 1.5, follow sloping line back to sp. gr. line 1.0, then go horizontally to right side of scale A. 4. From point on scale A draw a straight line to gas temperature 325° F. on scale G, intersecting plain scale B. 5. Draw a straight line from 60° F. on scale G through point on Scale B,

(Continued on Page 89)



Gas line flow chart for ordinary plant use in design. Note: Inches of mercury 4.91 = lbs./sq. in. Lbs./sq. in.x2.0358 = inches of mercury

Phillips Now Operates 38 Natural Gasoline Plants

In the past year the Phillips Petroleum Co. has maintained practically the same operating capacity in its natural gasoline plants as in the previous year despite the general observance of curtailed operations. The company retains its position as the largest factor in the industry and at present is operating plants having a total capacity of 1,247,500 gallons per day and is holding idle plants having a total capacity of 82,000 gallons per day. Of the total idle capacity above, 37,000 gallons of it is accounted for in the plants shut down in the past year.

This includes the 15,000-gallon plant at Breckenridge, Tex., located in SE Section 8, T.&P. Survey, Block 5, Stephens County; the 2,500-gallon plant at Necessity, located in Block 15, T.&P. Survey, Block 6, Stephens County; the 7,500-gallon plant at Oil City, Tex., in the southeast corner of R. D. Owens Survey, A. 2,240, Young County, Texas, and the 12,000-gallon plant at Roeser in the SW SW Section 17, T.&P. Survey, Block 8, Stephens County, Texas.

Although the idle capacity of the company's plants continued small during 1932 it does not mean that actual production has not been curtailed in proportion to the industry as a whole. While no actual production figures are available, it is known that the Panhandle area, where the company has a large part of its total capacity, has produced less gasoline, along with other important fields in the United States.

Argentine Company Will Distribute Liquefied Gas

Within the next three months large quantities of liquefied petroleum gases will be available throughout Argentine as the result of the completion of "cracking" units at plants in Plata and Comodoro Rivadavia. The gas will be distributed by Yacimientos Petroliferos Fiscales and the appeal for purchasing the new product will be that the fuel will contain five times the heating value of "city" gas.

The high-pressure cracking units that have been installed for the purpose of manufacturing the gas operate on petroleum oils, particularly the heavy residual oils. The plants will produce the ordinary propane and butane gases which will be compressed and utilized by industries and in homes. Heating has been done with small charcoal burning stoves in most of the communities outside of the cities and in the city the high cost of the manufactured gas has proved a handicap for its extensive sale.

This installation differs from those in the United States in that the plant itself has been specifically designed to manufacture a maximum quantity of gas from the oil. In the United States the liquefied gases are products of a cracking operation designed to make motor fuel or from the stabilizing of natural gasoline. The preponderance of the volume of liquefied gases manufactured in the United States comes from natural gasoline and the volume has increased yearly. Methods for distributing the fuel will not differ greatly from those used in the United States except that this fuel will supply a larger number of people in one community and approach the ordinary manufactured gas distributing system so common in the cities and towns outside of the areas supplied with natural gas.

Let's Go America!

The American public is supporting actively efforts of President Roosevelt to rehabilitate business. The petroleum industry is fortunate in being the principal vehicle through which it is hoped to re-establish normal business conditions. It behooves every branch of the oil business to do its part in getting "quick action", the slogan of the administration in Washington.

WARREN PETROLEUM COMPANY

"Just Natural Gasoline"

TULSA, OKLAHOMA

"JUST NATURAL GASOLINE"

NEWS FOR PETROLEUM REFINERS

Elect B. L. Boye President of the Asphalt Institute

At its annual meeting the board of directors for The Asphalt Institute, representing three-fourths of the major asphalt producers of the United States and Canada, elected B. L. Boye president of the organization to succeed William H. Kershaw of The Texas Company. Mr. Boye, who has been with the Standard Oil Co. of New York for 33 years, is now

B. L. BOYE

in charge of that company's asphalt and fuel oil activities. Other officers elected were: Vice presidents, Leroy M. Law, Shell Petroleum Corp.; A. M. Maxwell, president of the Standard Oil Co. of Ohio, and J. A. Blood, Standard Oil Co. of California.

W. W. McFarland, president of the Warner-Quinlan Co., was elected secretary, and Herbert Spencer, Standard of New Jersey, was elected treasurer, with W. E. Gilligan of the same company as assistant treasurer. The board named C. W. Bayliss, Barber Asphalt Co., to be chairman of the new executive committee, with J. S. Helm Standard Oil of New Jersey, and Messrs. Boye and McFarland as the other members of that committee. J. E. Pennybacker continues as managing director of The Asphalt Institute.

INSTALLING NEW BOILERS

The Empire Oil & Refining Co. is installing two 750-horsepower Babcock & Wilcox 250-pound boilers in its refinery power plant at Ponca City. These boilers will replace smaller ones and included in the new construction program are a new boiler feed water pump, stack and control instruments.

Work has been started and plans call for its completion within three months. Contracts for the equipment have been let.

NEW TYPE PLANT IN TEXAS

WICHITA FALLS, Tex., Mar. 25.—A small refinery of 100 bbls. capacity is scheduled to start operating here before the end of the month. The plant is owned by Roy I. Carter and associates and is located on the site formerly occupied by a refinery of the Lone Star Refining Co. The refinery has the Bach-Cook system of processing.

ADDITIONAL CRACKING SUITS

The Universal Oil Products Co. has filed suit in the Federal District Court at Wilmington, Del., against the Octane Oil & Refining Co. alleging infringement of the clean circulation patent No. 1,392,629 and also patent No. 1,890,974. The Octane company operates a refinery built about two years ago at Baird, Tex.

The Texas Company has filed suit against Garber Refinery, Inc., in connection with the operation of a cracking plant, located at the Garber company's refinery at Garber, Okla. The bill of complaint, which has just been filed in the U. S. District Court for the western district of Oklahoma, alleges infringement of Hall patents Nos. 1,175,909, 1,239,099, 1,239,100, 1,242,795, and Behimer patents Nos. 1,840,012 and 1,883,850.

Appoint Kistler Receiver of Grayburg Oil Company

Frank E. Kistler, Tulsa, and Ernest L. Kistler, San Antonio, last week were appointed receivers of the Grayburg Oil Co. which operates a 3,000-bbl. refinery at San Antonio. The receivers were appointed by Federal Judge Duval West on application of the Indiana Southwestern Gas & Utilities Corp. The action by the Indiana company was brought for foreclosure of a lien and deed of trust securing $1,875,000 worth of bonds purchased by the plaintiff company in June, 1931.

Frank E. Kistler has been president of the company and is also chairman of the board of the Oklahoma Natural Gas Corp. The Grayburg company recently sold its chain of 18 retail stations in San Antonio to the Magnolia Petroleum Co.

NEW COLLECTION LAW IN TEXAS

With the signing of the bill last week by the governor, a new gasoline tax collection law became effective immediately in Texas. The new law aims to prevent evasion which it is estimated resulted in a loss of state revenue totaling $4,000,000 last year.

The new law creates a class of dealers which includes all persons other than distributors who sell and transport motor fuel in Texas. Comprehensive records are required to be kept by all dealers and distributors showing the purchase and sale of gasoline, kerosene, naphtha, distillate and casinghead or natural gasoline.

All movements of these products must be under a uniform and consecutively numbered manifest, subject to investigation by tax supervisors, highway patrolmen and peace officers who, in the enforcement of the law, have the right to stop motor vehicles to determine whether the taxes on motor fuel have been paid.

All violations of the penal section of the law are felonies and conviction automatically forfeits the right to a distributor's permit for two years. In addition, civil penalties are provided to be recovered in suits brought by the State.

APPOINT LONDON, MANAGER

R. D. Jordan has resigned as Omaha, Neb., division sales manager of the Skelly Oil Co. He was succeeded by L. S. London, until recently assistant sales manager.

ASSOCIATED GETS CONTRACT

The Associated Oil Co. has been awarded a contract for 1,000,000 gallons of gasoline for delivery about May 7 at Balboa and Cristobal in the Panama Canal zone.

GASOLINE MUST BE BLACK

SANTA FE, N. Mex., Mar. 25.—Distributors of gasoline in New Mexico are concerned as to how they will carry out the provisions of a new act of the state legislature. The new law states that all gasoline sold to persons entitled to tax exemptions must be colored black. Gasoline has been dyed many colors but not black and several distributors have protested to Governor Seligman that it is impossible to manufacture the gasoline. The law also provides penalties for retailers who do not offer the black gasoline for sale.

Report Pan American to Purchase Crown Central

The Pan American Petroleum & Transport Co., subsidiary of the Standard Oil Co. (Indiana), is reported to be negotiating for the purchase of the Crown Central Refining Co. The principal property of the Crown company consists of an 8,000-bbl. refinery on the Houston Ship Channel. The refinery, which was built several years ago, has Holmes-Manley cracking equipment. The company also has 170 producing wells.

If the Crown properties are purchased it is understood that the Pan American will definitely give up its plans to build a refinery at Texas City, Tex., where it has owned a site for some time. The Pan American recently announced plans to improve and enlarge its refinery at Baltimore, Md., operated by its subsidiary, the Mexican Petroleum Co.

OPERATE FORT NORMAN PLANT

Announcement has been made that Imperial Oil, Ltd., will operate its refining plant this summer at No. 2 Discovery well in the Fort Norman Field. The field is on the Mackenzie River about 53 miles north of Fort Norman, and the small plant is the farthest north of any American refinery. The well was put on production in 1932 for the first time since it was drilled about 1921, and a small refining plant which had been on the ground since then was used to produce gasoline from the crude. Some 30,000 gallons of gasoline and fuel oil were produced in the course of the season for use largely in the Great Bear Lake mining field about 300 miles east of Fort Norman. Operations were in charge of R. W. McKinnen of the Imperial staff.

LEE HAUGEN SUPERINTENDENT

Lee Haugen has been named superintendent of the Empire Oil & Refining Co.'s refinery at Ponca City, Okla. R. R. Mills, formerly superintendent, left the active service of the company more than a month ago and during this time Mr. Haugen was acting superintendent. Mr. Haugen's appointment places him at the head of the company's largest Mid-Continent plant. He has been assistant superintendent at the Ponca City refinery for nearly five years and prior to that was in the Tulsa general offices of the refinery division for several years. Mr. Haugen is a graduate chemical engineer of Iowa State College.

PURE TO SELL TIRES

Pure Oil Co., effective immediately, is assuming the merchandising of the "Yale" line of tires manufactured by General Tire Co. The company announces that it expects to offer complete tire service at all stations east of the Rocky Mountains outside of the New England territory.

Sun to Install Equipment for Production of Propane

The Sun Oil Co. has announced plans for the construction of new stabilizer equipment at its Marcus Hook, Pa., and Toledo, Ohio, refineries. The construction of this equipment will be part of a program which contemplates the expenditure of $4,000,000 at its refineries during 1933. A third refinery is located at Yale, Okla.

One of the reasons responsible for the decision to install new stabilizing equipment was the production of propane, a light hydrocarbon for which a constantly increasing market is being opened up in the eastern states. The propane is used for heating and illuminating gas and also has a market as a substitute for acetylene in industrial work. The Sun company is understood to have closed contracts for a part of its propane output and will develop additional markets. Propane, the production of which formerly came exclusively from natural gasoline plants, is now being produced on a commercial basis by several refineries in the United States.

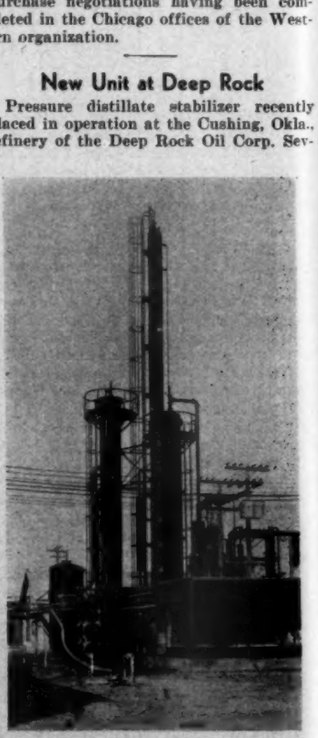
SKELLY ADDS 12 STATIONS

KANSAS CITY, Mo., Mar. 25.—The Skelly Oil Co. completed arrangements this week to add 12 filling stations to its retail outlets in Greater Kansas City, purchasing 10 existing station properties outright and leasing and developing two others.

The 10 stations purchased formerly were operated by the City Ice Co., many of them in connection with ice storage substations. These properties were bought from the Western Ice Service Co., a corporation related to the City Ice Co., the purchase negotiations having been completed in the Chicago offices of the Western organization.

New Unit at Deep Rock

Pressure distillate stabilizer recently placed in operation at the Cushing, Okla., refinery of the Deep Rock Oil Corp. Several other improvements have recently been made at the Deep Rock refinery. The stabilizer was designed by the Burrel-Mase Engineering Co.



A COMPLETE LINE OF QUALITY TUBES FOR THE REFINING INDUSTRY

Much of the remarkable progress made in the creation and application of alloy steels during the last few years can be credited to the technical pioneering of Timken metallurgists and the methods of quality control developed in the Timken Steel Mills.

This institution, the world's largest manufacturer of alloy steel tubing for many years, now offers the refinery industry a complete line of refinery tubes, any analysis and any size.

Timken refinery tubes are made for refinery men who are quality conscious. Quality of workmanship and precision is assured by two of the country's newest and most modern tube mills, supplemented by two smaller auxiliary specialty mills. Quality of material is made certain by the use of Timken steel, made in Timken furnaces, under Timken methods of quality control, and rolled on Timken bar and billet mills.

THE TIMKEN STEEL AND TUBE CO., CANTON, OHIO

TIMKEN STEEL TUBES

TANK WAGON MARKETS

Quotations for gasoline and kerosene in United States, as furnished by the larger marketing concerns, include taxes

March 28, 1933

Taxes

The gasoline quotations given in the following tables include the 1-cent Federal tax as well as state, county and city taxes. The gasoline quoted is the regular or standard grade. In most marketing areas a third or competitive grade is generally available at 1.5 or more cents per gallon under the service station price for the regular grade. Ethyl Gasolines are sold 2 cents above the service station price for the regular grade.

Southern District

STANDARD OIL CO (KENTUCKY)

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Atlanta, Ga.	20.0	20.0	7.0	12.0
Augusta	20.0	20.0	7.0	11.0
Macon	20.0	20.0	7.0	11.0
Savannah	20.0	20.0	7.0	12.5
Birm'ham, Ala.	17.0	17.0	8.0	12.0
Mobile	21.0	21.0	8.0	8.0
Montgomery	22.0	22.0	8.0	14.0
Jackson, Miss.	16.0	16.0	7.0	11.0
Vicksburg	18.0	18.0	7.0	9.0
Jack'ville, Fla.	21.0	21.0	8.0	9.5
Miami	21.0	21.0	8.0	13.5
Pensacola	20.0	20.0	8.0	13.0
Tampa	20.0	20.0	8.0	13.0
Lexington, Ky.	18.5	18.5	6.0	10.0
Covington	18.0	18.0	6.0	11.5
Louisville	18.0	18.0	6.0	10.0
Paducah	19.0	19.0	6.0	9.0

A third grade "Kyso Green" is sold at a price generally 3 cents below the price on the regular grade.

In addition to the state tax of 4 cents on gasoline, Montgomery has city and county tax of 3 cents on gasoline and one-half cent on kerosene. Kerosene prices in Georgia include 1-cent tax. In Florida, an inspection fee of 0.125 cent; in Alabama, an inspection fee of one-half cent on kerosene and one-fortieth cent on gasoline. To Pensacola, Montgomery and Birmingham state taxes add 1-cent tax. To Mobile state tax add 1-cent city tax. Dealers receive discount of 3 cents off tank wagon price throughout territory.

Southwestern District

MAGNOLIA PETROLEUM CO.

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Dallas, Tex.	12 5	15.0	5.0	7.0
Fort Worth	12.5	15.0	5.0	7.0
Houston	12.5	15.0	5.0	8.0
San Antonio	12.5	15.0	5.0	8.0
El Paso	12.5	15.0	5.0	8.0
Texarkana	*14.0	14.0	5.0	†11.0
Muskogee, Ok.	9.5	12.0	5.0	6.0
Okla. City	11.5	14.0	5.0	8.0
Tulsa	13.5	15.0	5.0	8.0
Ft. Smith, Ark.	*13.5	13.5	5.0	†10.0
Little Rock	14.5	14.5	7.0	†10.0

*Less 2½ cents to dealers. †Less 2 cents to dealers.

Standard Oil Co. (Indiana)

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Chicago	14.1	14.1	4.0	8.0
Decatur, Ill.	15.6	15.6	4.0	10.1
E. St. Louis	14.9	13.9	4.0	9.3
Joliet	15.6	14.6	4.0	8.6
Peoria	15.6	15.6	4.0	10.1
Quincy	15.4	14.4	4.0	7.5
Davenport, Ia.	15.7	15.7	4.0	10.4
Des Moines	15.7	15.7	4.0	8.0
Mason City	15.7	15.7	4.0	9.0
Sioux City	15.3	15.3	4.0	10.0
Duluth, Minn.	16.7	16.7	4.0	11.0
Mankato	16.3	16.3	4.0	8.1
Minneapolis	14.4	14.4	4.0	11.0
LaCrosse, Wis.	17.4	17.4	5.0	11.1
Green Bay	16.8	16.8	5.0	10.5
Milwaukee	16.2	16.2	5.0	10.0
Madison	16.5	16.5	5.0	10.2
Detroit, Mich.	15.0	15.0	4.0	8.0
Grand Rapids	15.5	15.5	4.0	8.0
Saginaw	15.8	15.8	4.0	10.8
Evansville, Ind.	16.2	15.0	5.0	†13.9
Indianapolis	16.4	16.4	5.0	†14.1
South Bend	16.7	16.7	5.0	†14.4
Fargo, N. D.	18.1	18.1	4.0	13.0
Huron, S. D.	17.5	17.5	5.0	10.0
Sioux Falls	17.0	17.0	5.0	10.0
K. C., Mo.*	14.1	14.1	4.0	7.0
Springfield*	15.0	15.0	4.0	8.0
St. Louis	13.0	11.5	3.5	9.4
St. Joseph*	13.0	10.9	4.0	7.5
Wichita, Kans.	13.9	13.9	4.0	7.0
Bartlesville, Ok.	13.5	13.0	5.0	8.0

*State tax 3 cents, 1-cent city tax and 1-cent Federal tax.

†Includes 4-cent tax. Buyers of kerosene not used as motor fuel can secure refund of tax.

Effective November 4, 1932—New dump discount applicable on all grades of gasoline sold from tank wagon. Any tank wagon customer buying 25 gallons or more at one time will be given 1-cent discount per gallon off tank wagon price at time of delivery. Customers not under contract receive no other discount.

Effective January 1, 1933—Discounts on C.D.A. on 500 gallons or more per month throughout territory; Red Crown Ethyl Gasoline, 3 cents off tank wagon price; Red Crown gasoline, 2½ cents off tank wagon price; Stanolind Blue gasoline, 1 cent off tank wagon price. On deliveries of 75,000 gallons or more each classification allowed 1 cent additional discount.

Discounts on resellers authorized agent's agreement: Same amounts as above except made off service station price instead of tank wagon price.

Stanolind Furnace Oil in Chicago

Effective November 1, 1932, prices f.o.b. Chicago, tank wagon prices: No. 1 (36-40 lt., stw, zero), 100 gallons or more, 7 cents; No. 2 (30-34 stw, zero), 150 gallons or more, 6½ cents; No. 3 (22-26 zero), 400 gallons or more 5.75 cents; No. 4 (12-16 zero), 400 gallons or more, 4.75 cents. Viscosity of No. 4, 90-115 at 100° F.

Fuel Oils

Associated Distributors Prices

Spot market prices on 250 gallons or over deliveries, and top prices on contracts, respectively: 38-40, 7 and 8 cents; 32-36 light, 6⅝ and 7⅝ cents; 32-36 dark, 6⅛ and 7⅛ cents; 28-30, 6¼ and 6⅝ cents; 24-26, 5 and 6 cents; 18-22, 4⅜ and 5⅜ cents. On deliveries of less than 250 gallons the spot price is one-half cent higher.

Naphtha

	Tank	
	Wagon	Car
Oleum spirits	10.7	6.22
V.M.&P. naphtha	12 7	7 22
Cleaners' naphtha	13.0	9.22
Stanisol	15.2	9 22

Tank wagon prices f.o.b. Chicago, January 6, 1933. Each of above prices subject to discount of 1 cent per gallon for 150-gallon lots if covered by contracts.

Rocky Mountain District

CONTINENTAL OIL CO.

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Denver, Colo.	14 0	17.0	5 0	12.5
Pueblo	14 0	17 0	5 0	12 5
Grand Junctn.	18 0	21 0	5.0	14.5
Casper, Wyo.	16.0	19 0	5.0	10.0
Cheyenne	14 0	17.0	5 0	11 5
Butte, Mont.	20 0	23 0	6 0	17.0
Billings	21.0	24 0	6 0	16.5
Great Falls	21 0	22.0	6.0	17 0
Helena	21.0	24.0	6 0	17 0
Salt Lake, Utah	16.0	19.0	6.0	16.0
Albu'que, N. M.	14 0	17.0	*7.0	12.0
Boise, Idaho	20.5	23 5	6.0	13 0
Twin Falls	20 5	23.5	6.0	13.0

*One-cent city tax.

Central South District

STANDARD OIL CO. (LOUISIANA)

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
N. Orleans, La.	15.5	15 5	*7 0	†11.0
Baton Rouge	15 0	15 0	6.0	†10 0
Alexandria	14 0	14.0	7.0	†8.5
Lafayette	15.0	15 0	7 0	†10.0
Lake Charles	15 0	15 0	7.0	†10 0
Shreveport	14.0	14 0	6 0	†11.0
Knoxville, Tenn.	19.5	19.5	8.0	12.5
Memphis	18 0	18 0	8.0	10.0
Chattanooga	19 0	19.0	8 0	12 0
Nashville	19.0	19.0	8 0	10 0
Bristol	18 5	18.5	8 0	13.0
Lt. Rock, Ark.	15.5	15.5	8 0	10.0

*Includes city tax of 1 cent. †Louisiana kerosene prices include 1-cent state tax. New Orleans kerosene price also includes 1-cent city tax.

Two-cent discount off kerosene tank wagon price and 2½ cents off gasoline tank wagon price to dealer and commercial accounts.

Nebraska

STANDARD OIL CO. (NEBRASKA)

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Omaha	16 3	17.3	5.0	9 0
McCook	17.0	17.0	5.0	8.5
Norfolk	16.3	17.3	5.0	10.75
N. Platte	17 0	17 0	5.0	9.0
Scottsbluff	17.0	17.0	5.0	9.5

Note — Dealers' discount allowed as follows: Red Crown Ethyl, 3 cents off station price; Red Crown, 2½ cents off normal service station price; Nebraska Blue (third grade), 1 cent off normal service station price.

Ohio

STANDARD OIL CO. (OHIO)*

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Ohio points	14.5	15.0	5.0	*13.0

*Two cents off on gasoline tank wagon to dealers and commercial accounts; 2½ cents off tank wagon and kerosene to dealers.

New York and Part of New England District

STANDARD OIL CO. (NEW YORK)*

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Albany, N. Y.	14.0	15.0	4.0	9.0
New York	13.5	13.5	4.0	9 5
Buffalo	13.5	14.5	4.0	9.0
Rochester	14.5	15.5	4.0	9.0
Syracuse	15.0	16.0	4.0	9.5
Boston, Mass.	14.0	14.0	4.0	8.0
Augusta, Me.	17.0	18.0	5.0	9.0
Manch'tr, N. H.	16.5	17.5	5.0	8.0
Burlington, Vt.	17.0	18.0	5.0	8.5

*Discount schedule to commercial accounts are as follows: At service stations, 1 cent per gallon; tank wagon deliveries up to 20,000 gallons monthly, 2 cents per gallon; 20,000 to 100,000 gallons, 2½ cents; 100,000 to 300,000 gallons, 3 cents; 300,000 gallons and up, 3½ cents.

Atlantic Coast District

STANDARD OIL CO. (NEW JERSEY)

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Atl'tic, City, N.J.	14.0	15.0	4.0	11.2
Newark	13.3	14.3	4.0	8.5
Annapolis, Md.	14.6	15.6	5.0	9.0
Baltimore	14.0	15.0	5.0	8 0
Cumberland	15 5	16.5	5.0	11.7
Wash'g'n, D. C.	13.2	13 2	5.0	10.0
Danville, Va.	16.7	17.7	6.0	10.9
Norfolk	15.1	16 1	6 0	10.3
Petersburg	16 2	17.2	6 0	11 4
Richmond	15.5	16 5	6.0	10.7
Roanoke	16.7	17 7	6.0	11.0
Charls'n, W. Va.	15 4	16 4	5.0	11.6
Parkersburg	14.0	15 0	5.0	10.2
Wheeling	15.0	16 0	5 0	11.2
Charlotte, N. C.	17.3	18.3	7.0	12.5
Hickory	18 5	19.5	7.0	12.7
Mt. Airy	18.6	19 6	7 0	12 8
Raleigh	18 1	19 1	7.0	12 3
Salisbury	18.0	19.0	7 0	12.6
Charleston, S.C.	16.1	17.1	7 0	10 3
Columbia	18.0	19.0	7 0	12.2
Spartanburg	16.0	16.0	7.0	12.5

Two cents per gallon discount off tank wagon price of gasoline to dealers except Washington, D. C., and Baltimore, Md., where discount is 3 cents. Kerosene 1 cent off tank wagon for 25 gallons or more under contract except New Jersey.

Canada

IMPERIAL OIL, LTD.
Imperial 3-Star Gasoline

	Gasoline			Kero.
	Tank wagon	Service station	Inc'lds tax of	tank wagon
Hamilton, Ont.	23.5	25.5	6 0	15 5
Toronto, Ont.	23.5	25.5	6 0	15 5
Brandon, Man.	29.0	32.5	7.0	17.5
Winnipeg, Man.	26.0	29.5	7.0	17.5
Regina, Sask.	29.0	33.0	6.0	21.5
Saskatoon, Sask.	31.0	35.0	6.0	25.5
Edmonton, Alta.	28.5	32.5	5.0	22.5
Calgary, Alta.	25.0	29.0	5.0	10.0
Vancouver, B.C.	26.5	29.5	7.0	22 5
Montreal, Que.	23.0	25.0	6.0	15 0
St. Johns, N.B.	24.5	28.5	7.0	20.5
Halifax, N.S.	23.5	27.5	6.0	20.5

Pacific Coast Territory

STANDARD OIL CO. OF CALIFORNIA*

	Gasoline			Kero.
	Tank truck†	Posted retail	Incl'ds tax of	tank wagon
Fresno	17.0	16.0	4.0	14.0
San Francisco	19.0	18.0	4.0	12.5
Los Angeles	16.5	15.5	4.0	13.5
Reno, Nev.	22.0	23.0	5.0	15.5
Portland, Ore.	17.0	16.0	5.0	13.5
Seattle, Wash.	18.0	17.0	6.0	13.5
Tacoma	18.0	17.0	6.0	13.5
Spokane	20.9	19.9	6.0	18.0
Phoenix, Ariz.	18.0	20.0	6.0	116.0

*Retail prices posted by Standard Stations, Inc., a subsidiary.

†Above prices are at company's plant or depots as company does not operate stations. A 4-cent per gallon discount is given dealers and customers taking tank wagon lots except in Phoenix where the discount is 1 cent. ‡Includes 5-cent state tax.

Pennsylvania-Delaware and Part of New England

ATLANTIC REFINING CO.

	Gasoline			Kero.
	Tank wagon	Service station	Incl'ds tax of	tank wages
Pittsburgh, Pa.	13.0	14.0	4.0	9.0
Philadelphia	13.0	13.0	4.0	9.0
Scranton	13.5	14.5	4.0	9.0
Allentown	13.5	14.5	4.0	9.0
Altoona	13.5	14.5	4.0	9.0
Erie	13.0	14.0	4.0	9.0
Dover, Del.	13.5	14.5	4.0	9.0
Wilmington	13.0	14.0	4.0	9.0
Springf'd, Mass.	14.5	14.5	4.0	8.0
Worcester	14.5	15.5	4.0	8.0
Boston	14.5	15.5	4.0	8.0
Providence, R.I.	13.5	13.5	3.0	8.0
Hartford, Conn.	13.5	13.5	3.0	8.0
New Haven	13.5	13.5	3.0	8.0

Discount schedule effective November 1, 1932. In Delaware and Pennsylvania, 3 cents off station price on purchases of 2,000 gallons or more per month, in remainder of territory 1 cent. Wholesale discount 2½ cents per gallon on monthly deliveries of 20,000 to 100,000 gallons, 3 cents on 100,000 to 300,000 gallons, and 3½ cents on more than 300,000 gallons.

TANK WAGON CHANGES

(Regular Grade Gasoline and Kerosene)

Standard Oil Co. (Nebraska), effective March 18, reduced kerosene tank wagon price one-half cent at Scottsbluff, Neb.

Standard Oil Co. of New Jersey, effective March 16, reduced kerosene tank wagon price 1 cent at Danville, Va.

Standard Stations, Inc. (Standard of California), effective March 18, reduced gasoline tank wagon and service station prices 2 cents at Fresno, Calif.; on same date gasoline service station prices were advanced .6 cent at Portland, Ore., and Seattle and Tacoma, Wash. Standard Oil Co. of California made the same changes in posted wholesale prices on the same date.

Magnolia Petroleum Co. reduced the kerosene price in El Paso, Tex., to 8 cents March 20.

Standard Oil Co. (Indiana) effective March 7 reduced kerosene tank wagon price from 9.9 to 7.5 cents at Quincy, Ill.; effective March 21 gasoline service station price reduced from 15.5 to 15 cents at Evansville, Ind.

CRUDE OIL PRICE CHANGES

On March 24 the Humble Oil & Refining Co. withdrew its flat price of 30 cents per barrel in Jones and Fisher Counties in Central Texas and put both fields in its Mid-Continent gravity schedule of prices. Under the gravity schedule the oil, it is said, will bring an average of 44 cents per barrel.

Effective March 27 all purchasers of Muskegon, Mich., crude oil paid $1 per barrel. The Old Dutch Refining Co. is seeking contracts for six months or more at $1. Naph Sol Refining Co. offers to pay daily, weekly or monthly. Wellman Oil Co. is in the buying scramble, all battling for the waning supply of Muskegon oil.

SCOUTS' CONVENTION

SAN ANTONIO, Tex., Mar. 2[illegible].—Local committees have been appointed for arrangements and entertainment of the tenth annual convention of the National Oil Scouts Association of America which meets in San Antonio at the Plaza Hotel on May 15 and 16.

The general arrangements committee consists of Jesse L. Bullard, of the Shell Petroleum Corp. as chairman with Joe M. Dawson of the Gulf Production Co., G. G. Thorne of The Texas Company, C. O. Falk of the Humble Oil & Refining Co. and John B. Shaw of the Mid-Kansas Co.

The finance committee is composed of M. J. Bonham of the Continental Oil Co. as chairman, T. H. Terry of The Texas Company and Cleve Phillips of the California Co.

Chairmen of other committees were named as follows: Entertainment, Joe M. Dawson; hotel arrangements, Jesse L. Bullard; registration, L. R. Caskey of the Republic Production Co.; transportation, Charles Stewart of the United Production Corp, and ladies' entertainment, Mrs. John B. Shaw.

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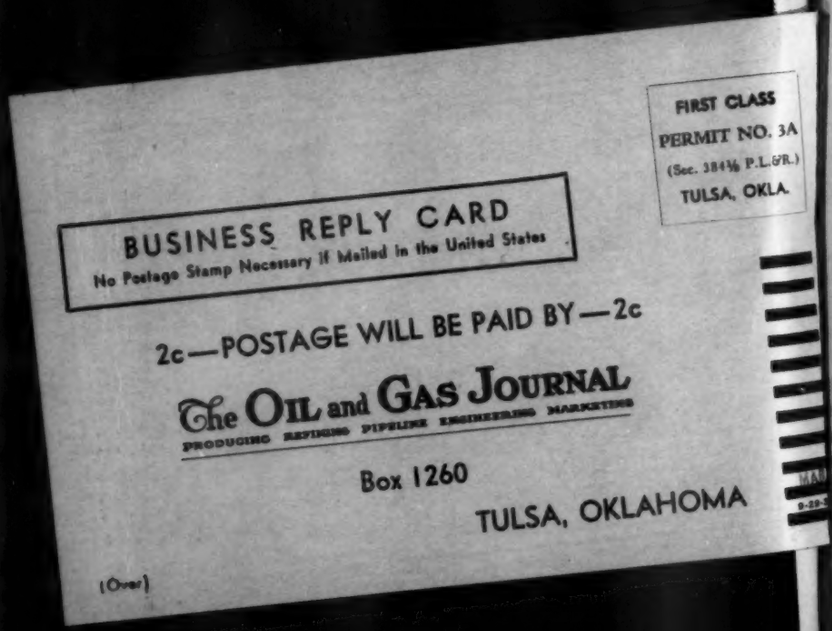
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Record Order for Pumps for Iraq Pipe Line Co.

NEW YORK, Mar. 27.—Worthington-Simpson, Ltd., of England, is now in production on an order for forty-five 6¾ by 24-inch horizontal duplex double-acting outside packed plunger forged fluid end pumps, with single reduction of helical gear and all moving parts entirely enclosed to protect against sand.

This order, the largest of its kind ever placed in England for pumping equipment, represents the complete main line pump requirements of the Iraq pipe line, now under construction.

The pumps will be driven by 500 horsepower Diesel engines, delivering against a line pressure of 800 pounds. All of the pumps will be built at Worthington-Simpson's works at Newark-on-Trent.

GEOLOGIST KILLED

John G. Marzel, of Cheyenne, who retired March 1 as state geologist for Wyoming, was struck by a train in Cleveland, Ohio, the past week and was instantly killed. He had been in Cleveland several weeks on a visit to his sister. He had gone east to recuperate from a recent illness.

NOT TO BUILD IN CANADA

PITTSBURGH, Pa., Mar. 25.—The Gulf Refining Co. has no immediate plans for the construction of a refinery in Canada, according to local officials. It was recently announced in New Brunswick that the company had definite plans for the construction of a plant in that province.

EUGENE H. EDWARDS DEAD

Eugene H. Edwards, 53, president of the E. H. Edwards Co., San Francisco, died recently of heart trouble. Mr. Edwards was born in San Francisco, started work for the Washburn-Moen Co. at the age of 16 and continued with the organization after it was taken over by the American Steel & Wire Co. In 1904 he went to work for the Pacific Steel & Wire Co., Oakland, Calif., later being made sales manager. He formed the E. H. Edwards Co. in 1908 and built the first wire mill on the Pacific Coast. Fabrication of wire rope became the company's principal business.

MUNICIPAL PLANT FOR GUYMON

GUYMON, Okla., voters have approved a proposal to construct a municipal gas plant by a vote of 384 to 40.

Control of Production to Prevent Depression

CHICAGO, Mar. 27.—A plan for setting up "economic dictators" over half a dozen of America's basic industries in an effort to restore lasting prosperity is outlined by John P. Torrence, president of the Link-Belt Co. Mr. Torrence described his plan for defeating recurring depressions as "purely selfish but economically sound"—it is simply "control the supply and the price will take care of itself."

"America is ready today for the upswing toward prosperity," he said in an interview. "Banking conditions are where they belong, and we're ready to start. But if prosperity returned tomorrow we wouldn't be able to keep it. Good times would put every manufacturer to work producing goods. It wouldn't be long before overproduction—the thing that caused this depression—would be greater than ever before."

Therefore, he said, a system must be devised to curb overproduction. He advocated dictators for such industries as coal mining, agriculture, steel and oil. Limited production in those fields, he said, automatically would hold production in other lines to consumer demands.

Mr. Torrence said the President and the Federal Trade Commission should have the authority to limit production, and a few thousand of the unemployed should get the jobs. It would be as easily enforced, he declared, as the present income tax laws.

"This emergency is just as critical as was the one in 1917," he said. "Why, therefore, can't we revive partly the powers of the War Industries Board and place them in the hands of the Federal Trade Commission and the Federal Farm Board?"

Mr. Torrence's plan of "enforcing common sense on the producers" would mean broadening the antitrust laws, he said.

"I wouldn't advocate abandoning them, but I believe the regulations could be tailored to fit present conditions. The management of bituminous coal mines could form a trade association representing 75 per cent of the industry and work things out to their own good—and the good of their employes and of the public—with the supervision of the Federal Trade Commission. Nobody would be hurt by it, and a lot of people would prosper."

California Crude Oil Prices

STANDARD OIL CO. OF CALIFORNIA
(Effective March 5, 1933)

For current purchases of crude oil at the well (unless otherwise specified). (All gravities above those quoted take highest price offered in that field.)

Gravity—	Long Beach	Seal Beach, Alamitos Heights	Huntington Beach	Inglewood	Playa del Rey	Olinda, Brea Canyon	Athens-Rosecrans	Torrance	Richfield	Whittier	Montebello	LaHabra, Coyote	Santa Fe Springs	Midway-Sunset, Elk Hills, Buena Vista Hills	Lost Hills	Coalinga
14-14.9	$.55	$.55	$.55	$.55	$.55	$.55	....	$.55	$.55	$.55	$.55	$.55	....	$.49	$.49	$.49
15-15.9	.55	.55	.55	.55	.55	.55	....	.55	.55	.55	.55	.55	....	.49	.49	.49
16-16.9	.55	.55	.55	.55	.55	.55	....	.55	.55	.55	.55	.55	....	.49	.49	.49
17-17.9	.55	.55	.58	.58	.58	.58	....	.57	.56	.57	.55	.55	....	.49	.50	.49
18-18.9	.57	.55	.61	.61	.60	.61	....	.59	.58	.59	.55	.57	....	.49	.52	.49
19-19.9	.59	.57	.63	.64	.62	.64	....	.61	.61	.61	.55	.59	....	.49	.54	.49
20-20.9	.61	.59	.64	.67	.64	.66	....	.62	.63	.63	.55	.61	....	.52	.56	.49
21-21.9	.63	.62	.66	.69	.66	.68	....	.64	.66	.65	.55	.63	$.57	.55	.58	.51
22-22.9	.65	.64	.68	.71	.69	.70	....	.66	.68	.67	.57	.65	.59	.57	.60	.53
23-23.9	.67	.67	.70	.73	.71	.72	....	.68	.70	.69	.60	.67	.62	.60	.62	.55
24-24.9	.69	.69	.72	.75	.73	.73	$.65	.70	.73	.71	.62	.69	.64	.63	.63	.57
25-25.9	.71	.72	.74	....	.75	.75	.68	.72	.75	....	.65	.71	.66	.66	.65	.59
26-26.9	.73	.74	.76	....	.77	.77	.70	.73	.77	....	.68	.72	.69	.68	.67	....
27-27.9	.75	.76	.77	....	....	.79	.73	....	.80	....	....	.74	.71	.71	.69	....
28-28.9	.77	.79	.79	....	....	.81	.75	....	.82	....	....	.76	.73	.74	.71	....
29-29.9	.79	.81	.81	....	....	....	.78	....	.84	....	....	.78	.76	.76	.73	....
30-30.9	.81	.84	.83	....	....	....	.81	....	....	....	....	.80	.78	.79	.75	....
31-31.9	....	....	....	....	....	....	.83	....	....	....	....	.82	.80	.82	....	....
32-32.9	....	....	....	....	....	....	.86	....	....	....	....	.84	.83	.85	....	....
33-33.9	....	....	....	....	....	....	.86	....	....	....	....	.86	.85	.87	....	....
34-34.9	....	....	....	....	....	....	.86	....	....	....	....	.88	.87	....	....	....
35-35.9	....	....	....	....	....	....	.86	....	....	....	....	....	.90	....	....	....
36-36.9	....	....	....	....	....	....	....	....	....	....	....	....	.92	....	....	....
37-37.9	....	....	....	....	....	....	....	....	....	....	....	....	.94	....	....	....
38-38.9	....	....	....	....	....	....	....	....	....	....	....	....	.96	....	....	....
39 and over	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

Signal Hill—Met on same day by The Texas Company, Union Oil Co. and General Petroleum Co., and Associated Oil Co.

Huntington Beach—The Texas Company, Union Oil Co., General Petroleum Co. and Associated Oil Co. schedules stop at 26-26.9 degrees, 75 cents.

Seal Beach, Alamitos Heights—The Texas Company met all prices; Union Oil Co., General Petroleum Co. and Associated Oil Co. schedules stop at 26-26.9 degrees, 75 cents.

Athens, Rosecrans, Domingues—Union Oil Co. schedule stops at 25-25.9 degrees, posting 32-32.9 degrees, 85 cents; 33-33.9 degrees, 87 cents; 34-34.9 degrees, 89 cents; 35-35.9 degrees, 90 cents. Associated Oil Co. met Standard Oil Co. schedule; General Petroleum Co. met Standard Oil Co. prices, stopping at 32-32.9 degrees at 86 cents.

Torrance—Met by The Texas Company. Met by Associated Oil Co, General Petroleum Co. and Union Oil Co., up to 25-25.9 degrees, at 75 cents.

Inglewood—Met by Associated Oil Co. and General Petroleum Co.

Playa Del Rey—(Prices subject to 5 cents per barrel gathering charge. Met by Union Oil Co. schedule starting at 19 gravity.

Olinda-Brea Canyon—Met by Union Oil Co. Met by General Petroleum Co., up to 25-25.9 degrees at 75 cents.

Santa Fe Springs—Met by The Texas Company, General Petroleum Co., Union Oil Co. and Associated Oil Co.; schedules start at 24-24.9 degrees, 64 cents, and end at 35-35.9 degrees, 90 cents.

East Coyote—Effective March 5, Union Oil Co.: 14 to 16.9 degrees, 55 cents; 17-17.9 degrees, 57 cents, with 2 cents added for each degree upward to 24.24.9 degrees, at 71 cents.

Richfield—Met by The Texas Company; met by Union Oil Co. up to 25-25.9 degrees, at 75 cents.

Montebello—Met by Union Oil Co. up to 25-25.9 degrees, at 65 cents.

Kern River, Mount Poso, McKittrick, Sunset, Midway, Elk Hills, Buena Vista Hills—Effective March 5, Union Oil Co.: 11-13.9 degrees, 44 cents; 14 to 19.9 degrees, 49 cents; 20-20.9 degrees, 52 cents; 21-21.9 degrees, 55 cents; 22-22.9 degrees, 57 cents; 23-23.9 degrees, 60 cents; 24-24.9 degrees, 63 cents; 25-25.9 degrees, 66 cents; 26-26.9 degrees, 68 cents; 27-27.9 degrees, 71 cents; 28-28.9 degrees, 74 cents; 29-29.9 degrees, 76 cents; 30-30.9 degrees, 79 cents. Associated Oil Co. scheduled in Midway, Elk Hills and Buena Vista Hills starts at 11 to 13.9 degrees, 44 cents; same as Union Oil Co. schedule from 14 to 29.9 degrees; 30-30.9 degrees, 79 cents. General Petroleum Co.: Effective March 5 in Midway-Sunset same as Associated Oil Co.; Fruitvale, Kern River, Mount Poso and Round Mountain, 49 cents for all grades.

Montebello—Met by Union Oil Co. up to 25-25.9 degrees, at 65 cents; The Texas Company's schedule in Montebello and North Whittier, 14 to 21.9 degrees, 55 cents; 22-22.9 degrees, 57 cents; 23-23.9 degrees, 60 cents; 24-24.9 degrees, 62 cents; 25-25.9 degrees, 65 cents; 26-26.9 degrees, 68 cents.

Santa Paula—Union Oil Co., March 5, 14 to 19.9 degrees, 55 cents; 20-20.9 degrees, 56 cents, with 1 cent added for each degree upward to 25-25.9 degrees, at 61 cents, and then 2 cents added for each degree upward to 30-30.9 degrees, at 71 cents. The Texas Company posts similar schedule in Santa Paula and Shiells Canyon.

Lost Hills-Belridge—Met by Associated Oil Co. and Union Oil Co., with Union Oil Co. paying 44 cents for 11 to 13.9 degrees gravity.

Coalinga—Met by Union Oil Co. and Associated Oil Co. on March 5 and General Petroleum Co. on March 15, but latter company and Associated Oil Co. posted 44 cents for 11 to 13.9 degrees effective March 5.

Ventura Avenue—Associated Oil Co., March 5, 22-22.9 degrees, 58 cents, with 2 cents added for each degree up to and including 30-30.9 degrees at 74 cents. Effective March 15, General Petroleum Corp.

Orcutt—Union Oil Co., effective March 5: From 16 to 19.9 degrees, 49 cents; 20-20.9 degrees, 52 cents; 21-21.9 degrees, 55 cents; 22-22.9 degrees, 57 cents; 23-23.9 degrees, 60 cents; 24-24.9 degrees, 63 cents; 25-25.9 degrees, 66 cents; 26-26.9 degrees, 68 cents.

Kettleman Hills—Effective March 5, Standard Oil Co., Union Oil Co. and Associated Oil Co.: 33 to 33.9 degrees, 66 cents, with 2 cents added for each degree upward to 39-39.9 degrees at 78 cents. Effective March 15, General Petroleum Corp.

Elwood—Prices f.o.b. ship—Standard Oil Co. of California, effective March 5: 33-33.9 degrees, 82 cents; 34-34.9, 85 cents; 35-35.9 degrees, 87 cents; 36-36.9 degrees, 89 cents; 37-37.9 degrees, 91 cents. Met by Union Oil Co.

Newhall, McKittrick and Kern River—Standard Oil Co. of California, 55 cents for all grades, effective March 5.

Wheeler Ridge—Standard Oil Co. of California, effective March 5: 14 to 20.9 degrees, 49 cents; 21-21.9 degrees, 50 cents; 22-22.9 degrees, 52 cents; 23-23.9 degrees, 54 cents; 24-24.9 degrees, 56 cents; 25-25.9 degrees, 58 cents.

Rincon—General Petroleum Corp., effective March 15: 22-22.9 degrees, 54 cents; 2 cents added for each degree upward to 30-30.9, at 70 cents.

Crude Oil Prices

(Continued from Page 21)

Fort Collins, Wellington and Greasewood, Colo., are on contract basis.

Florence (Jan. 18, 1933)	.32
Dutton Creek, Wyo. (Jan. 18, 1933)	.34
Rock Creek, Wyo. (Jan. 24, 1933)	.46
Franie, light (Jan. 18, 1933)	.31
Frannie, heavy (Jan. 18, 1933)	.20
Salt Creek	

See Stanolind Mid-Continent price schedule

LaBarge.....Mid-Continent gravity scale	
Big Muddy (Jan. 18, 1933)*	.40
Grass Creek (Jan. 18, 1933)	.62
Grass Creek, heavy (Dec. 15, 1932)	.45
Elk Basin, light (Jan. 18, 1933)	.62
Lance Creek (Dec. 16, 1932)	.92
Poison Spider (Mar. 5, 1931)	.79
Hudson (June 2, 1931)	.65
Lander (Mar. 5, 1931)	.40
Rex Lake (Feb. 22, 1930)	1.10
Osage (Jan. 18, 1933)	.62
Lost Soldier (Apr. 12, 1932)	.80
Hamilton Dome (Dec. 16, 1932)	.25
Torchlight (Jan. 18, 1933)	.62
Greybull (Jan. 18, 1933)	.62
Cat Creek (Jan. 18, 1933)	.62
Pondera (Nov. 7, 1932)	.60
Sunburst, Mont. (Nov. 7, 1932)	.75
Hogback, N. Mex. (Jan. 18, 1933)	.65
Lea County, N. Mex. (Jan. 20, 1933)	.30
Maljamar (Jan. 20, 1933)	.35
Artesia-Jackson (Jan. 20, 1933)	.30

Note—Salt Creek, Cat Creek, Dry Creek, Dallas-Derby, Hudson, Greybull, Hogback and Iles by Stanolind Oil & Gas Co. and remainder by Ohio Oil Co. Both companies posted Grass Creek light and Elk Basin. Lost Soldier posted by Producers & Refiners Corp. Artesia, Jackson and Maljamar posted by Continental Oil Co. Lea County, effective January 20, posted by Humble Oil & Refining Co. Fort Collins, Wellington, Orchard, Florence, Rattlesnake and Table Mesa by Continental Oil Co. Osage posted by Arro.

*Posted by Continental Oil Co.

Middle Western States

OHIO OIL CO.
(Effective January 18, 1933)

Lima (Jan. 10, 1933)	$ .70
Wooster	.70
Illinois	.62
Indiana	.49
Princeton	.62
Plymouth	Shut in
Western Kentucky	.57
Midland, Mich. (Dec. 31, 1932)*	.95
Somerset, Ky. (Jan. 19, 1933)	.45
Muskegon, Mich. (Mar. 27)	See note

*Posted by Pure Oil Co. Producers Pipe Line Co. pays 5 cents per barrel over Pure Oil Co.'s posted price. Muskegon: All companies pay $1 per barrel effective March 27. Somerset, Ky., crude purchased by Ashland Refining Co., Ashland, Ky., and delivered through own pipe line.

Mexico

Panuco*	$ .44

*F.o.b. ship, based on January transactions and exclusive of production and export taxes and bar dues.

Canada

Ontario (Jan. 18, 1933):	
Petrolia*	$1.75
Oil Springs*	1.82
Turner Valley†:	
Crude oil, 31°-35.9° (Jan. 24, 1933)	1.41
Crude oil, 36°-49.9° (Jan. 24, 1933)	1.90
Crude oil, 50° up (Jan. 24, 1933)	2.41
Discolored naphtha (Jan. 24, 1933)	2.58
Crude naphtha (Jan. 24, 1933)	2.82

*Imperial Oil, Ltd. †Imperial Oil, Ltd., and Regal Oil & Refining Co.

"Experience Always Pays"

WORLD'S WORST WELL FIRE!

extinguished in 94 days by Kinley Company

This famous Rumanian gas fire, Well No. 160 of the Societe Romana-Americana, Morenci Field, Rumania, was extinguished in 94 days, by the M. M. Kinley organization, after it had raged for more than 2 years and had defeated several elaborate attempts to put it out. In another 95 days after it was extinguished, the Kinley Company had brought the well under control.

At the time it was successfully extinguished this fire presented a difficult problem, as the raging flame had created an immense crater around the well, 250 feet across and 65 feet deep.

The Kinley organization has coped with many special problems, presented by a long series of oil and gas well fires. Has never had a failure.

M. M. KINLEY COMPANY
Tulsa, Oklahoma

Specializing in Capping Wild Wells, Extinguishing Well Fires

Roosevelt Is Asked to Appoint Oil Supervisor

(Continued from Page 11)

(G) By limiting imports to the average for the last six months of 1932.

C. If the foregoing conservation program is to succeed the committees respectfully submit that it must be based on a price for crude oil which will allow a margin of profit to the producer and a price for the refined products which will allow a margin of profit for the refinery and the retail dealer.

Report Submitted to Roosevelt

Secretary Ickes thanked the delegates for their intelligent discussion of the subject before them and said he would at once place the recommendations before President Roosevelt for such action as he may approve.

It is considered certain that these recommendations will meet the approval of the President and that he will communicate with Congress in a short time asking for necessary legislation.

Reaction of Wirt Franklin

"This is the first time I have ever known of a unanimous report in the oil industry," said Wirt Franklin, president of the Independent Oil Producers of America. "You know how a man feels with the toochache. He will take anything to stop it. That is the way we are now."

The report as agreed on was at first interpreted even by those who took part in drafting it as a dictatorship but after more careful study of its language they believe it is practically aimed at two rackets—hot oil and the gasoline tax racket, said one member of the Committee of Fifteen.

Oil Men Agree on Plan

Independent oil men's associations and the American Petroleum Institute Monday agreed upon the plan they approve for correcting the difficulties the oil industry is experiencing by a failure to prorate oil production to meet consumer requirements.

Pursuant to the request of Secretary Ickes the independent oil men met at the Mayflower Hotel and by a practically unanimous vote adopted its resolutions. The first conflicting sentiment had been voiced by John B. Elliott of Los Angeles, representing the Independent Petroleum Association of California, at a preliminary meeting of the delegates held last evening. Elliott and E. B. Howard, W. M. Keck and J. Edward Jones left the meeting declaring against any curtailment agreement. They were not present at the formal meeting today but J. R. Parten, president of the Independent Petroleum Association of Texas, submitted a minority report which was voted down, basing his objection on the restriction of oil production.

The majority resolution of the independent oil men was then voted on and approved by a vote of 13 to 1, with four associations not voting. In the same hotel there was a meeting of the committee of the American Petroleum Institute, and that committee, after a discussion of the resolution approved by the independents, gave it their approval so that practically all branches of the industry went on record as in favor of the identical recommendations.

The combined associations and their representatives favoring these resolutions were: American Petroleum Institute, W. R. Boyd, Jr.; California Oil and Gas Association, Ralph B. Lloyd; Central Pennsylvania District Oil and Gas Association, W. J. Brundred; East Texas Land Association; East Texas Producers and Royalty Owners Association; General Mid-Continent Oil and Gas Association, W. N. Davis; Independent Petroleum Association of America, Wirt Franklin; Independent Petroleum Association of Ohio, I. C. Grimm; Mid-Continent Oil and Gas Association, Kansas-Oklahoma division, Louisiana division, Texas division, W. N. Davis; North Texas Oil and Gas Association, Charles I. Francis; Oil Producers Sales Agency of California, Ralph B. Lloyd; Southeastern Ohio Oil and Gas Association, I. C Grimm; Texas Oil and Gas Conservation Association, Charles F. Roeser; West Central Texas Oil and Gas Association, West Virginia Oil and Gas Association, W. S. Hallanan; Middle District Producers Association (Pennsylvania), W. J. Bundred; a total of 19. The California Oil and Gas Association did not vote. The Independent Petroleum Association of California was not present and the Independent Petroleum Association of Texas voted no.

Secretary of Labor Present

While the oil groups were placing themselves on record the representatives of governors were assembled in executive session. Secretary Ickes, accompanied by Miss Perkins, Secretary of Labor, welcomed the representatives of governors and read his address pointing out the difficulties of the oil industry he wished to remedy. He said in part:

Statement of Secretary Ickes

"It has been suggested that the Federal Government should co-operate with the oil producing states to bring about uniform production not in excess of 2,000,000 bbls. of crude each day for the United States during the remainder of the present year, and that equitable allocation of this total be fixed definitely as between the various states and the individual pools therein.

"Acceptance of this production figure, I am advised, would approximately bring production and consumption into balance for the immediate future."

Detailing troubles facing the industry, Mr. Ickes said: "Widespread tax evasion, the illegal production and irregular distribution of unmarketable production, the failure or inability to enforce existing state statutes—all have had a tendency to break down the legitimate conservation programs of the various states. Evasion of both the Federal and state gasoline taxes has in itself unsettled the market for gasoline, the chief product of petroleum, the country over."

Mr. Ickes asserted that 100,000 to 300,000 bbls. of "bootleg" oil were being produced daily, and declared that leaders in the industry should make every effort to aid enforcement agencies in preventing this illegal flow.

"Destructive influences and clashing interests," he said, "are bringing the oil industry, ranking among the great industries of the nation, to its knees."

Can Prevent Reckless Dissipation

Saying the nation's oil resources are being wasted by the lack of control, the secretary declared: "It has frequently been asserted that the Federal Government is without power to control or even regulate the production of petroleum from privately owned lands, except in case of drainage from government lands. But it is by no means certain that the people of the United States are helpless to prevent the reckless dissipation of an indispensable natural resource.

"The states can, of course, under their reversed police power, respectively regulate and control the capture of petroleum within their respective territories to any extent which will prevent waste and loss of oil, and also natural gas, and in aid of such purpose can prevent owners of surface rights from drawing oil in a manner wasteful of the oil and gas beneath the surface of other owners.

"For two years proration of production in the major Mid-Continent fields has been in operation. State regulatory bodies and industry leaders have sought in vain for a balancing of supply and demand. During this period there has been an upbuilding of 'potentials,' price has turned downward, production upward, and bootlegging of illicit oil has flourished. The whole price structure has collapsed. Out of this maze of confusion and conflicting interests must come a means of control or limitation of production that will assure a continuing, adequate domestic supply of oil that will not and must not exceed actual consumption requirements. Only by this means can the industry right itself."

Committee of 15 Appointed

The representatives of governors discussed their problem and finally appointed a committee consisting of C. C. McDonald, Texas; William H. Cooley, of Bakersfield, Calif.; Cicero I. Murray, of Oklahoma; I. C. Grimm, of Ohio, and Gov. Alfred M. Landon, of Kansas, and empowered them, to represent the group of governors in coming into agreement with the oil men.

The American Petroleum Institute appointed Judge C. B. Ames, W. C. Teagle, Standard Oil Co. (New Jersey); K. R. Kingsbury, Standard Oil Co. of California; R. C. Holmes, The Texas Company, and D. J. Moran, Continental Oil Co., as its representative committee, and Wirt Franklin, William N. Davis, Charles F. Roeser, W. J. Brundred and T. H. Barton were selected to constitute the committee for the group representing the independent oil men's associations.

Ask Congress for Legislation

The Committee of Fifteen held meetings on Tuesday and finally agreed upon a report which was submitted to Secretary Ickes at a conference late in the afternoon.

After glancing through the report, Secretary Ickes authorized the following statement:

"In substance, the tentative report says that conditions in the oil industry have brought about a situation where it cannot be effectively handled by co-operation between the states and the industry.

"The suggestion is made that the National Government help out in the emergency. It may be necessary to ask Congress for emergency legislation.

"The suggestion looks toward the naming of a representative by the Federal Government with rather wide powers to curtail overproduction and stop bootlegging."

Secretary Ickes and Governor Landon both warned the oil conferences that unless the states and the industry are able to co-operate in controlling production, emergency dictatorship by the Federal Government will be necessary.

Secretary Ickes gave a hearing Tuesday to representatives of the California Independent Oil Producers Association, E. B. Howard and Mr. Elliott; the Texas independent oil producers, Maj. J. R. Parten and others.

Minority Claims No Overproduction

The California and Texas independent oil producers not included in the three main groups of governors, independents and American Petroleum Institute members making up the Committee of Fifteen held another meeting Wednesday at which they adopted a new set of resolutions as modifications of their pronouncements yesterday. This was done at the suggestion of Secretary Ickes, who hoped to bring them in line with the kind of control he desires. However, after being closeted for an hour the group headed by Elliott, president of the California Oil Producers Association, came out with its report declaring "there is no overproduction of petroleum in the United States today."

This group met today under the name of the new organization they brought into existence last night known as the Independent Petroleum Association Opposed to Monopoly.

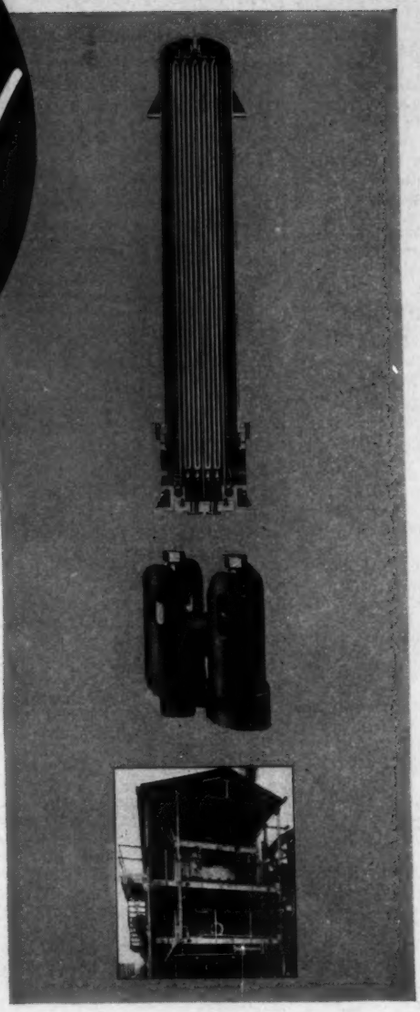
President Meets Independents

President Roosevelt on Wednesday received a delegation of independent oil producers who have been attending the governors conference at the Department of Interior. The delegation was headed by John B. Elliott. Following the conference Mr. Elliott announced that independent producers had been permitted to present their side of the oil situation to the President who was particularly anxious to learn the facts. He said the conference had been entirely satisfactory.

OPEN FLOW TEST ENJOINED

Federal Judge Bryant on Wednesday of this week granted an injunction enjoining the Texas Railroad Commission from ordering the opening of wells in East Texas for a two-hour open flow to take a potential test of the field. The injunction is to remain in force until the three-judge Federal court can pass on the question.

Within the Brief Period of a Year



Lummus, a *progressive* engineering organization, has made available and placed in successful operation—

—a new and much improved type of high pressure heat exchanger of high heat transfer rate with simplified cleaning and accessibility.

—Lummus Self-Locking Sectional Return Bend of forged alloy steels for reliability under modern high temperature and pressure conditions.

—a new type of oil heating unit, which combines uniform heating with high heat transfer rates.

Lummus has for several years operated a completely equipped experimental laboratory with apparatus of semi-commercial size. This laboratory is devoted solely to the development of distillation processes that produce greater yields and lower costs for the petroleum industry.

Lummus is a *progressive* engineering organization. Its developments merit your consideration.

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PETROLEUM REFINING PLANTS

Okla. Senate Passes Proration Bill With Minor Amendments

OKLAHOMA CITY, Okla., Mar. 28. The senate today passed the new oil conservation bill after making some amendments and sent it back to the house. It is expected to pass the house as amended. The bill strengthens the measure passed in 1915 because it provides severe penalties for violation of the orders of the corporation commission, which body is given all the authority to carry out the law. The commission is authorized to appoint the oil umpire and the proration attorney, and in turn the umpire appoints his assistants, each of whom must have had five years or more of actual field experience. Under the contempt penalty the commission may seize properties of the offender to satisfy the fine imposed.

Potentials are to be taken at intervals not to exceed each six months, and proration is to be on a per-well basis, as now effective in Oklahoma City. This will require a complete change in the proration set-up in other prorated fields of the State.

Jones Favors Continuance of Oil Proration Program

WICHITA FALLS, Tex., Mar. 24.—Roy B. Jones, president of the Panhandle Refining Co., and former president of the Western Petroleum Refiners Association in an address here before a luncheon club called on the local oil industry to support the program to curtail oil production in line with current requirements.

"Potential production, with no proration, is 10,000,000 bbls. per day," Mr. Jones said. "Consumption is less than 2,000,000 bbls. With no proration, the price of oil, will be a nickel a barrel or less, which means that the 15,000 wells in the Wichita Falls area, with the possible exception of the flowing wells at Chalk Hill, would all have to shut down. In addition to these wells, 17,000 more in the Breckenridge or West Central Texas area, which have even less production per unit, would also have to close. Thousands of men would be thrown out of work, banks would fail, and a business collapse would occur which would make our present business situation seem like boom times in comparison."

If a condition of no proration should continue for a period of 60 to 90 days, Mr. Jones estimated that at least 300,000 wells in the United States would be shut down and never reopened.

Committee Again Has Gross Production Tax

OKLAHOMA City, Okla., Mar. 28.—The gross production tax bill which was defeated in the house of representatives is back in committee. The house rescinded its action and referred the measure back for changes that might make it acceptable. It may be reported out of committee with the minimum 2 to 3 cents per barrel tax eliminated, and the ad valorem tax feature modified so that it will apply only to equipment actually used in the production of oil.

ITALY USING CHARCOAL GAS

The use of "charcoal gas" in motor trucks and tractors in Italy to cut down Italy's gasoline bill by 50,000,000 lire is projected in experiments which the Italian government has been making in the new fuel. Italy is importing annually something like 5,000,000 quintals of gasoline and kerosene, for which she spends 430,000,000 lire.

One big objection to the use of charcoal gas is the forests cannot go for long being despoiled of trees, but the use of charcoal for house fuel in Italy is diminishing with the increased use of gas and electricity.

East Texas Crude Production and Shipments

AUSTIN, Tex., Mar. 27.—Reports received here at the Texas Railroad Commission indicate crude oil production in the East Texas fields during the 24 hours ending 7 a.m. March 25 totaled 778,875 barrels, with reported production at 631,381 barrels, showing a difference, attributed to hot oil production of 147,494 barrels. It is interesting to note that reported production was 231,381 barrels in excess of the field allowable and that actual production was 378,875 barrels more than the allowable. Following is the report:

Main line pipe line gauging, 24-hour period ending 7 a.m. March 25, for East Texas oil field:

	Barrels
Stock on hand, 7 a.m. March 24	1,760,595
Receipts, 24 hours	631,381
Deliveries out of field for period	453,754
Tank cars, 630	133,395
	587,149
Stock on hand, 7 a.m. March 25	1,917,321
Gauged and estimated used by refineries	35,000
Pipe line storage increase	156,726
Indicated production	778,875

A.P.I. Topical Committees for This Year Announced

Topical committees for the Division of Production of the American Petroleum Institute, to deal with metallurgy of oil field equipment and drilling practice, have been appointed by Charles F. Roeser, vice president and chairman of the general production committee. A. C. Rubel, of the Union Oil Co. of California, Los Angeles, is national chairman of the committee on drilling practice operating under the Central Committee on Drilling and Production Practice. John F. Dodge, of the University of Southern California is the national secretary of the committee.

Blaine B. Wescott, of the Gulf Research Laboratories at Pittsburgh, heads the Committee on Metallurgy of Oil Field Equipment. Personnel of the two committees by districts follows:

Committee on Metallurgy

California district: K. V. King, Standard Oil Co. of California, San Francisco (chairman); C. J. Coberly, Kobe, Inc., Los Angeles; C. W. Froome, Union Oil Co. of California, Santa Fe Springs; Harry Hayes, Alhambra; R. A. March, Shell Oil Co., Los Angeles; W. Howard Clapp, California Institute of Technology, Pasadena.

Eastern district: F. N. Speller, National Tube Co., Pittsburgh, Pa. (chairman); M. T. Archer, National Supply Co., Toledo; Frank Bayless, Oil Well Supply Co., Oil City; K. A. Covell, Evanston; D. R. Dale, S. M. Jones Co., Toledo.

Mid-Continent district: Glenver McConnell, Shell Petroleum Corp., Tulsa (chairman); A. E. Olson, Olson Drilling Co., Tulsa; W. K. Whiteford, Barnsdall Oil Co., Tulsa.

Southwestern district: R. G. Hamaker, Reed Roller Bit Co., Houston (chairman); Frank Gardner, Simms Oil Co., Dallas; S. M. Greenidge, Texas Pacific Coal & Oil Co., Fort Worth; H. W. Fletcher, Hughes Tool Co., Houston; M. G. Stewart, Pelican Well Tool & Supply Co., Shreveport; R. A. Wilson, Dallas.

Committee on Drilling Practice

California district: Bruce Barkis, Rio Grande Oil Co., Los Angeles (chairman); C. J. Coberly, Kobe, Inc., Los Angeles; R. D. Copley, Standard Oil Co. of California, Los Angeles; L. A. Cranson, Honolulu Consolidated Oil Co., San Francisco; J. R. Gignoux, Shell Oil Co., Los Angeles; F. W. Hertel, Associated Oil Co., Ventura; W. F. Huff, National Supply Co. of California, Los Angeles; Wendell M. Jones, Petroleum Equipment Co., Los Angeles; Edmund Jussem, Jr., Union Oil Co. of California, Los Angeles; H. N. Marsh, General Petroleum Corp. of California, Los Angeles; P. C. McConnell, Standard Oil Co. of California, Los Angeles; M. N. Phillips, Continental Oil Co., Los Angeles; F. J. Shaver, consulting petroleum engineer, Ventura; Ben K. Stroud, National Tube Co., Los Angeles; E. P. Tallant, Union Oil Co. of California, Santa Fe Springs; D. K. Weaver; Wilshire Oil Co., Santa Fe Springs.

Eastern district: J. G. Montgomery, Jr., United Natural Gas Co., Oil City (chairman); H. H. Phillips, T. W. Phillips Gas & Oil Co., Butler; J. H. Newlon, The Philadelphia Co., Pittsburgh; J. French Robinson, Lycoming Producing Corp., Wellsboro; C. B. Turner, South Penn Oil Co., Pittsburgh; J. E. Wilson, Carnegie Natural Gas Co., Waynesboro.

Mid-Continent district: C. P. Parsons, Halliburton Oil Well Cementing Co., Duncan (chairman); C. W. Alcorn, Shell Petroleum Corp., Tulsa; John T Hayward, Barnsdall Oil Co., Tulsa; J. L. Trax, Gypsy Oil Co., Tulsa; W. K. Whiteford, Barnsdall Oil Co., Tulsa.

Rocky Mountain district: W. B. Emery, Ohio Oil Co., Casper (chairman); J. O. Dart, Stanolind Oil & Gas Co., Midwest; William H. Strang, U. S. Geological Survey, Casper.

Southwestern district: Blaine Johnston, Simms Oil Co., Dallas (chairman); W. T. Doherty, Humble Oil & Refining Co., Houston; H. B. Hurley, Continental Oil Co., Big Spring; L. K. Laney, The Texas Company, Fort Worth; Melbert Schwarz, Rio Bravo Oil Co., Geismar; W. C. Thomas, Magnolia Petroleum Co., Lake Charles; A. W. Thompson, Dallas; J. Vander Henst, Gulf Producing Co., Houston; A. H. Weyland, Arkansas Natural Gas Co., Shreveport.

OIL CONCESSION IN PALESTINE

A concession has been granted to two Palestinians to prospect for oil in a limited section of the country. The concessionaires do not seem to have much financial backing nor any experience in the oil business, but it is possible they represent unnamed interests. The land covered lies to the southwest of the Dead Sea, an area which was investigated to some extent in 1912 and then abandoned. However, many geologists are of the opinion that oil will eventually be found there in commercial quantities.

WILL SAVE PRESIDENT WORRY

AUSTIN, Tex., Mar. 27.—James E. Ferguson said for the governor's office Monday night the Texas delegates to Secretary Ickes' conference in Washington had been instructed to say that the State of Texas is able to and will take care of its oil situation, and as Roosevelt Democrats wish to save the President from that worry.

Late Fields

OKLAHOMA

Manahan and others' No. 1, Section 29-7-8, found the Cromwell sand at 3,085-92 feet with a showing of oil. This is an outpost well in the West Holdenville Field of Hughes County.

Mid-Continent Petroleum Corp.'s No. 1 Vieux, SW cor. SE Section 31-7-5, in the Sacred Heart area of Pottawatomie County, has been making 100 bbls. a day, half oil and half water, from the Simpson sand at 4,133 feet.

Watchorn Oil & Gas Co.'s No. 1 Zoeller, NW cor. SE Section 5-6-5, Pottawatomie County, was drilling in Simpson sand at 4,345 feet carrying a hole full of water. It was swabbed at a total depth of 4,330 feet making 100 bbls. part oil and water.

At the Five Civilized Tribes lease sale held March 24, in Muskogee, of the 110 tracts offered comprising 9,718 acres, 51 tracts were sold totaling 4,132 acres for a cash bonus of $23,636 for an average of $5.72 an acre. This was the largest sum an auction lease sale has brought since 1930. Leases were offered in the area near the discovery well in the Keokuk Falls district of northern Seminole County, where Gypsy Oil Co. paid $150 an acre for a 40-acre lease in Section 34-11-6.

KANSAS

Roy Ramsey and others No. 1, NW cor. SW Section 32-19-9w, on the Chase townsite in Rice County, found a hole full of oil in the conglomerate at 3,245-80 feet. The well is shut down for tankage.

McComb and The Texas Company's No. 1 Dyck, SW cor. NE SW Section 8-22-3w, an extension well in Hollow area of Harvey County, made 530 bbls. of oil in 15 hours from the chat at 3,170-3,201 feet.

The fourteenth Hunton lime well in the Mabee Pool, in McPherson and Harvey Counties, was being completed by the Mid-Kansas Oil & Gas Co. It was No. 2 Schmidt, SW cor. NW NE Section 33-21-3w, McPherson County, and extends the production one location to the north. It is estimated at 1,000 bbls. a day from the Hunton lime at 3,441-68 feet.

NORTH LOUISIANA

SHREVEPORT, La., Mar. 28.—Joe Modisette's No. 1 Frost Lumber Industries, NE cor. Section 20-9-13, Converse area, Sabine Parish, was bailed in as an estimated 50-bbl. pumper from the Annona chalk at 1,895 feet. It is half way and on a direct line between Gibson-Johnson's discovery well on Frost Lumber Co. land, C Section 19, and their No. 2 Frost Johnson in NW NE Section 15 and apparently is a much better well than either though it will require a 24-hour gauge on pump to determine.

OIL RESEARCH IN ITALY

In a paper read before the Italian Society for the progress of the sciences, it was stated that the presence of petroleum in Italy is now assured, the only doubt being as to its extent. Deep drilling is considered advisable in the Po Valley, as indications have been that deposits will be more satisfactory at considerable depths. In the Lombardy-Emilia-Romagna region the A.G.I.P. plans an average of one well for every 900 hectares in its present concession and probably more widely separated drillings elsewhere. The A.G.I.P. research has been in a zone of about 45,000 hectares between Piacenza and Parma. Only three drillings so far have warranted more intensive research and partial exploitation. Their total output is about 70 bbls. a day, which is tending to increase slowly. There is also a large supply of gas which can be utilized for light and power. The speaker pointed out that the work is difficult and costly, since great depth is necessary in many places. Research in central and southern Italy has been scarcely begun, but some favorable prospects are reported.

Economic Aspect of Utilizing Alcohols

(Continued from Page 16)

er and more flexible engine performance, easier starting and better idling. It was observed by many drivers that in cold weather starting this type of fuel required less use of the choke than with regular gasoline, and that there was an improvement in the operation of the cold motor.

3. Mileage Tests.—Between 200 and 300 road tests have been made by the civil engineering department using equipment owned by the Engineering Experiment Station. The test cars used were a Cadillac V-8 and a 1932 Studebaker coupe.

As a result of these tests, it is indicated that the use of certain blends consisting of butyl alcohol, acetone, ethyl alcohol, and gasolines (as described in b above) will result in a mileage at least equal to that obtained with regular gasoline.

The road tests show further that slightly lower mileage and lessened performance except at speeds less than 25 miles per hour are obtained when anhydrous ethyl alcohol-gasoline blends (described in a above) are used, such results being compared with those obtained from the use of regular gasoline.

It should be emphasized that all of the above alcohol-gasoline blends were used in ordinary automobile engines without carburetor adjustments of any kind; it should also be emphasized that additional mileage tests under varying atmospheric conditions must be made before definite conclusions can be reached on this point. These tests are in progress.

Summary of Technical Aspects

In summing up the technical, economic and sociological phases of the problem, Whitaker states, "The technical problems have been solved by the chemical and automotive engineers. We can accordingly deposit the 'fuel alcohol baby' upon the doorstep of the economist and social reformer, with full confidence that our obligation has been well performed. There are no technical difficulties remaining, either in the making of an alcohol suitable for fuel blends or in the use of the fuels made therefrom. The problem is now solely one of suitable economic conditions, and one of public will." While no "technical difficulties remain" in the production of alcohol, improvements in the process of the production of alcohols from cereals are certain to follow the revival of this industry. It also seems certain that improvements in the alcohol blends would follow their adoption on a large scale. The problem is, however, primarily one of economics and public will, for as long as the present attitude regarding uncontrolled flow of our petroleum reserves prevails, alcohol fuels must sell at a premium over unblended gasoline.

A very similar statement is made by Ricardo of England in the introduction to the last edition of his book on internal-combustion engines. "It is perfectly well known that alcohol is an excellent fuel, and there is little doubt but that sufficient supplies could be produced within the tropical regions of the British empire, yet little or nothing is being done to encourage its development. Judging from past experience, no active steps will be taken until a serious crisis has arisen, and since it must take at least 10 years to create the necessary organization and machinery for the production of alcohol on the scale which will be required, the crisis may be a serious and prolonged one."

The preliminary experiments which have been made at Iowa State College confirm the statements in the literature that alcohol-gasoline blends are suitable for present-day engines. The fuels will stand higher compressions without detonating than will gasoline. Motor performance at low speeds and full load has been improved in all makes of cars tested and with all grades and brands of gasoline when suitably blended with higher alcohols. The addition of ethyl alcohol alone to gasolines gave variable results. Complete information is not available as to mileage efficiencies but these will not be greatly affected by 5 or 10 per cent blends. Fuels of this type, if nationally available, would lead to engine developments resulting in increases in efficiency.

Summary of the Economic Aspects

The average Iowa farm price of corn at the present time is between 10 and 15 cents a bushel. While present prices prevail, corn (and perhaps other farm products) is a cheaper source of alcohol than molasses. Corn as a source of alcohol can compete freely with molasses and with synthetic alcohol if the price remains below 32 cents per bushel.

The price of corn will probably not stay as low as it is now for very many months. It is low at the present time because of two things—the world depression and the present bumper crop. If the corn crop in 1933 is of average size, the price of corn in Iowa should be 5 or 10 cents higher than it is at present. After the depression is over the price of corn in Iowa will depend largely on the general price level. If the general price level remains nearly 10 points below prewar levels, as it is at the present time, corn prices in Iowa can be expected to return to levels about half way between present prices and 1925-29 average prices. A new outlet for a large amount of corn would materially improve this situation.

Some form of governmental subsidy will be necessary before the alcohol-gasoline industry could use large quantities of agricultural crops. Preferential treatment of this sort, if justified at all, should be regarded as only temporary. In the long view, no industry should be subsidized or propped up unless it can show that before long it can stand on its own feet without protection of any kind. Any industry that cannot eventually get along without support should not be started in the first place.

There are two reasons, however, why this grain alcohol industry might deserve initial support. One of them is that agriculture is in great need of some help in its present emergency; it took five years for agriculture to make even an incomplete recovery from the 1920 depression, and it probably will take as long or longer for agriculture to recover from the present debacle unless something is done about it. The creation of a grain alcohol industry would shorten this period. The second reason is that our natural oil wells are flowing so freely at the present time that our oil supplies are being rapidly depleted and we will face a shortage and a high price in the not distant future. The sooner we develop the manufacture of alcohol from our grain, potato and other crops, the sooner will we begin to conserve our oil supplies and the better will we be able to cope with a shortage when it does arrive.

The governmental subsidy might take any one of several different forms. The compulsory blending of all gasoline as required in some foreign countries may not be desirable in the United States. Preferential taxation of the blended fuel over unblended fuel would remove the disadvantage of price difference and would result practically in national usage of such fuels. Another form of subsidy would be the creation of some governmental agency for the stabilization of grain prices by the removal of the excess production which would be turned over to the fermentation industry at a price permitting free competition in the motor fuel field. This amounts to a two-price level for grains similar to the present practice of the milk producers and raisin growers.

Legal Aspects

Before much progress can be made in the manufacture of alcohol for fuel purposes, the existing regulations concerning the manufacture of alcohol will need modification.

Under the National Prohibition Act government supervision of the manufacture, storage, distribution, sale and use of alcohol for scientific and industrial purposes is a major phase of the permissive system set up to enforce this act.

Existing regulations prohibit the Government from tracing industrial alcohol down the line of its varied uses beyond the first purchaser of alcoholic products manufactured by firms or individuals holding government permits. Hence, as a counter measure, the Government exercises close supervision of production, enforces denaturing regulations and maintains rigid inspection of the manufacturing plants.

Last, but not least, it exercises a considerable measure of control over production. Since January 1, 1928, the Federal Bureau of Prohibition has been limiting the quantity of industrial alcohol produced in the country as a whole. And certain states, of which Iowa is one, absolutely prohibits the manufacture of alcohol for any purpose whatsoever.

Conclusion

In conclusion, the conversion of substantial amounts of agricultural products, including corn, wheat, oats, barley, potatoes and others, to alcohol to be used in motor fuel might be used as a basis for a plan which would be a permanent cure for the ills now afflicting the agricultural industry. There are, however, many technical, economic and sociological problems yet to be solved. Many of the European nations, after a period of 10 years of research, have arrived at solutions which apparently meet their requirements. These plans cannot be transferred bodily to meet the different requirements prevailing in this country.

It might be desirable, in view of the present emergency, to make some definite move which would be of immediate value to agriculture. It would be perfectly safe to advocate the addition of 5 per cent of alcohol to motor fuel, since such a fuel certainly will not meet with any serious criticism on the basis of value. If all gasoline were so blended with alcohols prepared from corn and other cereals, approximately 550,000,000 bushels would be removed from the food market. This probably is enough to produce a definite increase in the prices of agricultural products. It should be possible to work out a satisfactory scheme for accomplishing this objective.

Intensive research should be started on the technical, economic and sociological problems which remain to be solved before an entirely satisfactory plan can be developed to meet future requirements.

New Mexico's Deepest Well Stands in Region Rich in the Navajo Legends

By JOHN A. FROST
Petroleum Engineer, U. S. Geological Survey, Farmington, N. Mex.

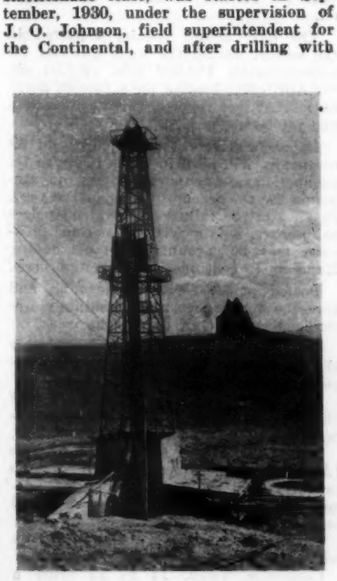
Interesting legends of the Navajo Indians are associated with the region in which stands the deepest well ever drilled in New Mexico and the deepest producer in the state, the Continental Oil Co.'s No. 24, on the Rattlesnake lease, Navajo Reservation, San Juan County.

Approximately 6 miles in the distance, as seen in the accompanying picture, stands an igneous intrusion, the "Winged Rock" of Navajo legends, rising abruptly from the level of the surrounding country to a height of 1,875 feet. The white man has given it the name "Shiprock" because of its resemblance to the silhouette of a sailing vessel at sea. Dykes plainly visible in the picture flanking the main body of the rock bear a striking resemblance to the outstretched wings of a giant bird. Though only a few feet in thickness they rise to a great height as sheer as the Chinese Wall.

This rock is sacred to the old Navajo. One of the legends concerning it is that Navajos were dying from hunger and severe cold in the far northland. In answer to their prayers a great bird flew from the north with the people on its back and eventually alighted at the present site, where it turned to stone after making known to them that this was their new home.

On the trip from the northland, according to the tradition, one of the great medicine men of the tribe died. He was buried on the top of the rock and his spirit is guarding the rock still, permitting no man to ascend it. The medicine man's spirit must be very vigilant for the rock never yet has been scaled. Many attempts have been made but no one has ever ascended more than 900 feet, and the one reaching that height fell and was severely injured.

The well, the second deep test on the Rattlesnake lease, was started in September, 1930, under the supervision of J. O. Johnson, field superintendent for the Continental, and after drilling with



rotary tools to a total depth of 7,370 feet was plugged back to 6,620 feet. Later cable tools were rigged up to clean out and place the well on production. The well was completed for production the latter part of September, 1932. The well is now making 150 bbls. a day on the pump.

Houston Oil Co. Elects Officers and Directors

HOUSTON, Tex., Mar. 27.—Directors and officers of the Houston Oil Co. of Texas and the Houston Pipe Line Co. have been elected as follows: Houston Oil Co.: George A. Hill, Jr., president; L. S. Zimmerman, vice president and treasurer; A. W. Standing, general manager; A. H. Kennerly, secretary-auditor, and George B. Pelton, assistant secretary.

Directors: Holman Cartwright, Samuel C. Davis, S. W. Fordyce, David Hannah, George A. Hill, Jr., A. H. Kennerly, L. S. Zimmerman, George E. W. Luehrmann, B. H. Lang, Thomas S. Maffitt, George D. Sears, Ethan A. H. Shepley and A. W. Standing.

Executive committee: Thomas S. Maffitt, chairman; David Hannah and L. S. Zimmerman.

Officers of the Houston Pipe Line Co.: George A. Hill, Jr., president; L. S. Zimmerman, vice president; Frank W. Kirk, general manager; A. H. Kennerly, secretary, and George B. Pelton, assistant secretary.

Board of directors: George A. Hill, Jr., Samuel C. Davis, A. H. Kennerly, Thomas S. Maffitt, McDonald Meachum, Holman Cartwright, David Hannah, Frank W. Kirk, George D. Sears, L. S. Zimmerman and Ethan A. H. Shepley.

Executive committee: Thomas S. Maffitt, chairman; David Hannah and L. S. Zimmerman.

East Coast Trade Anticipates Constructive Trend in Oil Markets During the Second Quarter

By A. E. MOCKLER
New York Bureau, The Oil and Gas Journal

NEW YORK, Mar. 27.—Refined oil market conditions were relegated to second place in eastern oil trade interest during the past week, with speculation rife as to what may be expected by the oil industry as a result of the Washington conference this week and recent conversations among oil leaders as to the industry's future policies with respect to crude oil production control. Notwithstanding the gloomy picture presented by current crude and refined markets, optimism continues to run high in informed oil trade circles, and there is a general anticipation of important constructive developments during the second quarter.

Numerous rumors are in circulation in the trade as to just what may be expected in the way of governmental support for measures to restore the oil industry to a stable condition, but is is generally believed that the new administration will lend a sympathetic ear to the industry's problems, and that any sane and constructive thoughts advanced for the solution of present difficulties will find prompt support in the right quarters. Many oil men here believe that their industry will be selected as the "key" industry in best position for immediate economic recovery, and that this recovery will be fostered in every way possible for its psychological effect upon other American industries, if for no other reason.

Oddly enough, price considerations have played an unimportant part in discussions of the market outlook, with the need for some effective action for regulation of production regarded as of paramount importance. It is believed, however, that anything which may be done to make proration effective will be reflected by a gradual strengthening in the price structure of the industry, which is now at unprofitably low levels on many products.

Competitive conditions in eastern gasoline markets have shown definite improvement, and while the market position is still somewhat shaky in some parts of the area, average prices are materially better than was the case a month or so ago, when price wars were in full swing in many important marketing centers. The question of the place of third grade gasoline in the marketing scheme still presents a difficult problem, however, and while leading companies would like to see third grades removed from the picture once and for all, it is evident that this product will continue to be used as a competitive weapon. Efforts will be made, however, to keep all "third grade" marketing campaigns strictly localised.

Refinery Gasoline

Posted prices were unchanged during the past week, with regular U. S. Motor grade quoted at 4¾ cents per gallon, and gasoline of 65 octane number and above at 5 cents per gallon, tank car lots, f.o.b. principal refinery centers. Demand from the jobbing trade was more active, and distributors were showing interest in placing contracts to cover their requirements during the second quarter. Refiners, however, are unwilling to book forward business at today's going prices, anticipating an early turn for the better in the market position.

A little price cutting is still reported in tank car markets, but the supply of low-priced gasoline appears to be limited, and leading refiners are not experiencing much difficulty in getting full posted prices on the average run of orders.

With the season of heaviest consumption at hand, refiners are looking for a material increase in gasoline consumption, and barring any further break in crude oil posted prices, better netbacks on gasoline sales are looked for.

With U. S. Motor gasoline available in cargo lots at 3 cents per gallon at the Gulf, and tankers available to move this motor fuel to ports in this area at 14 to 15 cents per barrel, Gulf Coast gasoline can still be brought into this territory and profitably handled, even at current low posted prices at refineries here. California gasoline, however, continues unattractive as an open market proposition here, although considerable quantities of the Pacific Coast motor fuel continues to move eastward on intercompany shipments.

Tank Wagon Gasoline

Tank wagon and service station prices are unchanged in this territory. In the Metropolitan area, isolated "sore spots" are still reported where gasoline is being retailed at 10 gallons for $1, or cheaper, but the average market here is being maintained at posted levels. Price competition is likewise still a factor in some spots in nearby New Jersey markets.

April 1 normally marks the start of the oil industry's six months of peak consumption, and marketers are anxiously awaiting the developments of the second quarter. Car registrations are improving, and it is expected that earlier estimates of probable consumption may be bettered somewhat by actual sales.

Intensification of the gasoline marketing operations of Pan American (Standard of Indiana) in the Atlantic Seaboard territory have been followed by the decision of the Standard Oil Co. of New Jersey to co-ordinate its marketing operations with those of two of its important subsidiaries, Colonial-Beacon Oil Co. and Standard Oil Co. of Louisiana, which will make for interesting and important changes in the marketing picture for the area.

Some speculation has been aroused in gasoline marketing circles over the possible effects of the legalization of beer on gasoline consumption. Many marketers appear to believe that motoring will increase as a result of the return of beer.

Kerosene

The advent of spring has been noticeable more by the calendar than the weather, and the demand for kerosene for heating purposes in the East has continued active. Refiners were getting a good call throughout the past week and the market held steady at 5¼ cents per gallon for 41-43 water white in tank car lots, which was a half cent per gallon over the posted price for U. S. Motor gasoline. California kerosene continues to move eastward, a total of 134,000 bbls. having been landed at Atlantic Coast ports during the fortnight ended March 18. Most of the California kerosene is going into New England through Tiverton, R. I., and Fall River, Mass.

With the refinery markets showing continued steadiness, tank wagon kerosene markets were also well maintained, no price changes developing during the period under review. Leading marketers report that their current retail gallonage is in excess of that for this time last year.

Bunker Oil

Continued firmness in the fuel oil market at the Gulf has made for a steady tone for bunker "C" oil at Atlantic Coast ports, with refiners continuing to post 75 cents a barrel, bulk, at terminals, plus the usual lighterage charge of 5 cents per barrel for delivery f.a.s.

While reports from the field indicate a weaker crude oil market, which would naturally affect the position of bunker oil, refiners here continue confident regarding the market outlook for this product, and it appears to be believed that hitherto unlooked-for constructive developments in the oil situation may eventuate in the near future which will entirely change the present market picture.

Although shipping operations at present continue along curtailed lines, more optimism is reported in marine circles, and steamship operators are looking for early improvement in import and export trade, and resultant betterment of business conditions in the shipping field.

Gas Oil

Gas manufacturing companies are drawing supplies against contract in substantial volume, and the market is in steady position at 4 cents per gallon for 28 gravity minimum oil, tank cars, f.o.b. refineries. There was little business reported on the spot position, although refiners continued to quote full posted prices on such sales.

With refinery operations continuing on a curtailed basis, every effort is being made by refiners in this area to hold down surplus stocks of gas oil, and supplies are being drawn from California and the Gulf to eke out requirements here where shortages develop.

Diesel Oil

Gallonage in this branch of the market is not up to refiners' expectations,

(Continued on Page 111)

Exports and Imports of Refined Products, Receipts of California Oils in the East

NEW YORK, Mar. 27.—Export markets were quiet throughout the entire week, largely due to unsettled conditions in crude oil. Late in the week, leading export sellers withdrew from the market entirely, and it is indicated that they will refuse to quote on export business until the Washington conferences come to an end. The trade is optimistic regarding the outcome of the governor's meeting, but the fear is expressed that unless positive action is decided upon, crude oil markets will break sharply, with the market flooded with distressed oil.

The only actual inquiry reported in the market during the week was one for approximately 150,000 bbls. of fuel oil, for April/May loading for a foreign destination. At last reports, this business had not yet been placed.

Representatives of principal world oil companies will meet in Paris today to fix production and export quotas for Rumania for the second quarter of the year. In view of the failure of world oil prices to improve, it is expected that some difficulty may be encountered in persuading Rumania to continue its production curb.

Posted prices for both gasoline and kerosene for export were nominally unchanged at the Gulf during the week.

Only one tanker fixture for export shipments from this country were reported during the week, as follows:

Motorship Athel (British), 12,000 tons (90,000 bbls.) fuel oil, California to Japan, two trips, 10s., April/May loadings.

Steamship Cities Service Empire (American) was fixed for two voyages to carry fuel oil from the Gulf to domestic ports north of Hatteras, at 15 cents per barrel.

Tanker charter rates during the week were quoted as follows:

Coastwise, clean, 14 to 15 cents a barrel; dirty, 15 cents a barrel.

Intercoastal, clean or dirty, 42 cents a barrel.

Transatlantic, Gulf to United Kingdom/Continent, clean or dirty, 8s. 6d. per ton.

Some interesting developments in connection with Rumanian and Russian sales in the export market were indicated by foreign tanker charters fixed last week, as follows:

Motorship Laurelwood (British), 9,500 tons (76,000 bbls.) refined oil, Black Sea to Shanghai, 13s. 6d., April loading.

Motorship Sveve (Swedish), 9,000 tons (72,000 bbls.) refined oil, Black Sea to Shanghai, 13s. 6d., April loading.

Motorship Fosna (Norwegian), 11,000 tons (88,000 bbls.) refined oil, Black Sea to Shanghai, 13s. 6d., April loading.

Motorship Sildra (Norwegian), 10,000 tons (80,000 bbls.), refined oil, Black Sea to Continent, 6s. 3d., April loading.

Motorship Nyholm (Norwegian) 8,000 tons (60,000 bbls.) dirty, Black Sea to Continent, 7s. 6d., April loading.

Motorship Beusten (Norwegian), 7,400 tons (59,200 bbls.) refined oil, Black Sea to Montevideo, 16s., prompt loading.

Motorship Ida Knudsen (Norwegian), 13,000 tons (97,500 bbls.) dirty, Abadan to Swansea, 15s., option United Kingdom/Bordeaux/Hamburg range, 15s. 6d., April loading.

Motorship Aase Maersk (Danish), 8,500 tons (64,000 bbls.) dirty, Batoum to Ceuta, 5s. 6d., April loading.

Motorship Strix (Norwegian), 1,000 tons (8,000 bbls.) part cargo refined oil, Constanza to White Booth Roads, 8s. 6d., prompt loading.

Motorship John P. Pedersen (Norwegian), 2,000 tons (16,000 bbls.) part cargo, Constanza to Grangemouth, private terms, prompt loading.

Steamer Mendocino (Norwegian) 65,000/70,000 bbls. fuel oil, Aruba to Cuba, 10 cents per barrel, April loading.

Motorship Oljaren (Swedish), 7,000 tons (52,000 bbls.) dirty, Black Sea to Denmark, 7s. 6d., April loading.

Motorship Chr.Th.Boe (Norwegian), 7,500 tons (60,000 bbls.) gas oil Black Sea to United Kingdom/Continent, private terms, prompt loading.

Steamer Riva Ligure (Italian), 1,230 tons, clean, Constanza to Etang de Bene, £1,150, April loading.

Petroleum Exports

The following table shows exports of principal refined petroleum products reported from the Port of New York during the three weeks ended March 18

(Continued on Page 118)

Chicago Area Marketers Believe Roosevelt Can Put Petroleum Industry on Its Feet Quickly

By R. C. CONINE
Chicago Bureau, The Oil and Gas Journal

CHICAGO, Mar. 27.—While refined petroleum products markets in the Chicago district were tending easier Monday due to scrambled affairs in the principal crude oil producing areas, confidence in the ability of President Franklin D. Roosevelt to straighten out the oil industry has prepared refiners and marketers of the district for an overnight change toward normalcy. The extent of this faith in the national leader is matched only by the extent of hopelessness in the efficacy of current attempts at stabilization.

It is interesting to note that marketers who have assailed "political interference" in the past appear to be content to place the tangled skeins of the industry in the hands of President Roosevelt. One marketer said that the men he had talked to feel that any action the Chief Executive may decide upon will be as foreign to "politics" as the decisions of a military commander in war time. These observations indicate the principal topic of conservation in the Chicago district oil trade circles.

Fuels Lead Downward Revisions

Distillates and fuel oils, in spite of extended seasonal demand, display greater weakness than other products with the exception of bright stocks which have reacted to price cuts in Pennsylvania. Kerosene appears to be in better demand, but considerable of what is said to be full specifications material is being offered at the low of prices as shown in The Oil and Gas Journal for last week. A few refiners in the district report that they have advanced their kerosene postings an eighth of a cent. In the special naphthas there were three upward revisions. One of these, on cleaners' naphtha, is apparently in response to decreased price cutting activity off the tank wagon. Major sellers recently cut the cleaners' naphtha tank wagon price 2.2 cents a gallon to 13 cents in Chicago. In the Detroit district this naphtha is reported to be selling off the tank wagon for as low as 9 cents a gallon.

Premature Heating Oil Cut

One of the larger distributors of heating oils in the Chicago district reduced the tank wagon prices on all grades of oils a quarter of a cent recently in anticipation of the lower freight rate on distillates not usable for illuminating oil purposes. This marketer has returned to the higher schedules. On April 1, it is expected that major and semimajor sellers will reduce the tank wagon posting on the light grades a quarter of a cent, and on the heavy grades, one-half a cent.

Tax Exempt Tractor Fuels

Refiners in the Chicago district are watching with interest the developments in North Dakota, South Dakota, Nebraska and Minnesota in connection with tax exempt tractor distillates and naphthas. In North Dakota regulations are already in effect controlling specifications of materials free of state tax. In South Dakota new regulations will go into effect on July 1, 1933. It is expected that other states will establish sets of specifications for tractor fuels which shall be exempt from motor fuel state taxes, and for this reason the characteristics of materials now exempted from the state levy are of interest.

Until July 1, tractor fuels of the following general specifications will not be taxed: 90 per cent point not below 490° F., endpoint not below 525° F., flashpoint may be below 105° F. in the open cup but not below 90° F. After July 1: Initial, 250° F. minimum; 90 per cent point, 490° F. minimum; endpoint, 525° F. minimum, and flashpoint, 110° F. minimum. Specifications of three tractor fuels which are now tax exempt in South Dakota are as follows:

	Dist.	Naph.	Dist.
Gravity	38.3	49.5	35.5
Initial	352	212	370
10 per cent	381	259	420
50 per cent	414	358	474
Endpoint	510	430	570
Color	1 NPA	w.w.	p.w.
Flashpoint	135	70	165
Firepoint	135	70	181

The octane rating on the distillate in the first column only is reported. This is 39.5 octane number. Some of the materials sold in the Northwest, particularly the naphthas, are suitable for use in some automobiles and for this reason the refiners in a few cases are coloring the tax exempt tractor fuels. One tractor naphtha was ruled against in tax exemption. This material had the following specifications: Gravity, 48; initial, 158; 10 per cent, 233; 50 per cent, 305; endpoint, 401, with flash and fire at 70. The octane rating was 48.

Coincidences and Salesmanship

At least one major refiner has good cause to complain because of the ill effects of coincidence. For 13 years this refiner has served a Wisconsin jobber and service station operator satisfactorily Not long ago a semimajor's account opened a station close to the station of the major company's customer and began cutting prices ruthlessly with a nationally branded product. At about the same time, during a marketers meeting, the sponsors of the price cutter answered the complainant in person to the effect that they could not control the price cutter because they needed coverage at the point under fire. However, the officials of the semimajor company said, the trouble could be ironed out very easily if the major company's customer would take their brand. They could then chase the price cutter out of that town. And thus the trouble was cleared up.

Service Station Price Cuts

In the Chicago district a number of independents are selling a good grade of gasoline at 11 cents a gallon, tax of 4 cents included, while an extremely low octane gasoline is being marketed at 10 cents a gallon. A district refiner who processes Michigan crude oil is selling his gasoline at 3.70 cents, delivered Chicago, or 1.258 cents, Group 3. Adding the tax to this gasoline bring the price to 7.70 cents, and to this must be added handling charges, rental, fees, etc. Recent price changes at the principal points in the territory are as follows: Regular grade gasoline service station price was cut from 15.5 cents to 15 cents at Evansville and the third grade posting was reduced from 13.5 cents to 11 cents at the service stations; St. Joseph, the tank wagon price on the regular grade was cut from 13 cents to 10.9 cents. At Bartlesville the third grade service station price was cut from 13 cents to 12 cents, and the tank wagon price was cut from 13 cents to 11 cents. At Quincy the kerosene tank wagon price was cut from 9.9 cents to 7.5 cents.

Evansville promises to rival St. Joseph as a hot bed of price cutting. On the regular and third grade the Evansville postings have been cut three times in a single week. One of the larger marketers in this city is offering 57-64 octane guaranteed (C.F.R. Research Method) to the trade at the average price of the below 57 octane gasoline. Upon payment for material before the twenty-seventh of each month the seller will give a rebate which is governed by the quantity of materials purchased. The gasoline is seasonally adjusted. Either party to the contract must give 12 months' notice, and under no circumstance is the buyer to use the name of the refiner in print or word of mouth.

Short-Sighted Practice

One recent incident is related by a Chicago district refiner and the significance is clear. A major refiner on the Gulf Coast recently sold two heat exchangers, which cost $3,000 apiece, to a budding refiner in the East Texas area for $100 each. The heat exchangers were utilized as condensers, and the output of the new plant will probably add to the flood. It would be interesting to discover how much used equipment the larger refiners have sold to potential market wreckers.

Gasoline Tank Car Prices

Gasoline tank car prices appeared slightly easier Monday, although refiners are showing some disposition to wait for developments in the crude oil situation before committing themselves over any period of time. Ruling prices are unchanged, but it is reported that more material is being offered on a distress basis fractionally under the postings of representative sellers.

Special Naphtha Tank Car Markets

The special naphtha tank car markets appear to be in a better position than last week, and there have been minor upward revisions. While natural gasolines have affected certain naphthas adversely, the attitude of principal sellers is working favorably. At least three refiners have made definite decisions to

(Continued on Page 100)

Do You Remember?

From The Oil and Gas Journal Files

25 Years Ago

March 30, 1908

J. W. Sloan, of the Oklahoma Iron Works, has patented a pump for oil wells which operates without sucker rods or cups. He calls it the O.K. pumping device.

Representative Holland, of Tulsa, has introduced a bill in the Oklahoma legislature forbidding the use of fuel in railroad locomotives that will emit sparks or throw off cinders. This is looked upon as a "boost" for oil as fuel.

Groves, Stearns & Fisher, drilling for oil in the Osage Indian Nation, have drilled six successive gas wells, and must turn them all over to the Indian Territory Illuminating Oil Co. which holds the gas rights but which will pay for the drilling of the wells.

T. V. Morian died at his home in Titusville, Pa. Mr. Morian has an interest in 5,000 bbls. of crude oil which the owners had held more than 30 years awaiting a profitable market, but new fields kept down the price throughout the years.

20 Years Ago

April 3, 1913

Bottled natural gas, called gasol, is being marketed out of Pittsburgh, Pa. It is made from a process discovered by Walter O. Snelling, Ph. D. It is an illuminant and also is used for welding and brazing.

Port Arthur, Tex., has the largest oil refinery in the world. It is owned by the Gulf Refining Co. It handled 13,000,000 bbls. of crude oil in 1912. There are 123 refineries in the United States, handling 139,190,430 bbls. in 1912. Standard Oil refineries handled 79,122,330 bbls., and non-Standard companies 60,078,100 bbls.

The Britton-Johnson Oil Co., an Oklahoma concern, capitalized at $50,000, has paid $25,000 per month dividends in the last four months. It operates in the rich Bird Creek Field north of Tulsa.

W. G. Skelly and family, of Wichita Falls, Tex., are visiting in Tulsa. Mr. Skelly has been successful in the North Texas Field.

10 Years Ago

March 29, 1923

Phillip Howard Taxman, of the Taxman Refining Co., is married to Miss Ethel Eunice Cohan of Chicago.

Horace G. Fitzpatrick, of Independence, Kans., has been placed in charge of the Kasoming Oil Co.'s properties in Wyoming.

Crude oil prices in Oklahoma and Kansas and North Central Texas range from $1.50 for below 28 gravity up to $2.60 for 41 gravity and over with 36 gravity bringing $2 per barrel. Pennsylvania Grade oil is quoted at $4 and $4.25.

Edward J. Maire, of the Maire Brothers, Lima, Ohio, noted veteran oil producer in Ohio and Oklahoma fields, died at Palm Beach, Fla.

and TAILOR-MADE for EACH STATE

SKELLY

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KANSAS CITY, MISSOURI
MINNEAPOLIS, MINN.
CHICAGO, ILL.
OMAHA, NEBR.

Forty-four facts every 15 minutes, facts on temperature, speed, mileage, atmospheric conditions, wind velocity, humidity, exhaust gas analysis, etc., were taken by the automotive engineer in charge of each Skelly test car. Over 300,000 facts a month were sent in by each test car in the Skelly test car fleet. These facts were necessary to Tailor-make New Skelly Aromax Gasoline.

Only Skelly Gasoline is High Test, High Anti-Knock and Tailor-Made for *each state*. That's why only Skelly jobbers and dealers can show such startling sales increases .... gallonage increases from 25 to 200 percent on this new gasoline ..... thousands of new customers driving in every day. The hundreds of thousands of motor car owners who have given New Skelly Aromax Gasoline the starter button and accelerator test and are continually coming back for more, *prove* that this new gasoline has met their demands.

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SKELLY OIL COMPANY, U. S. A.

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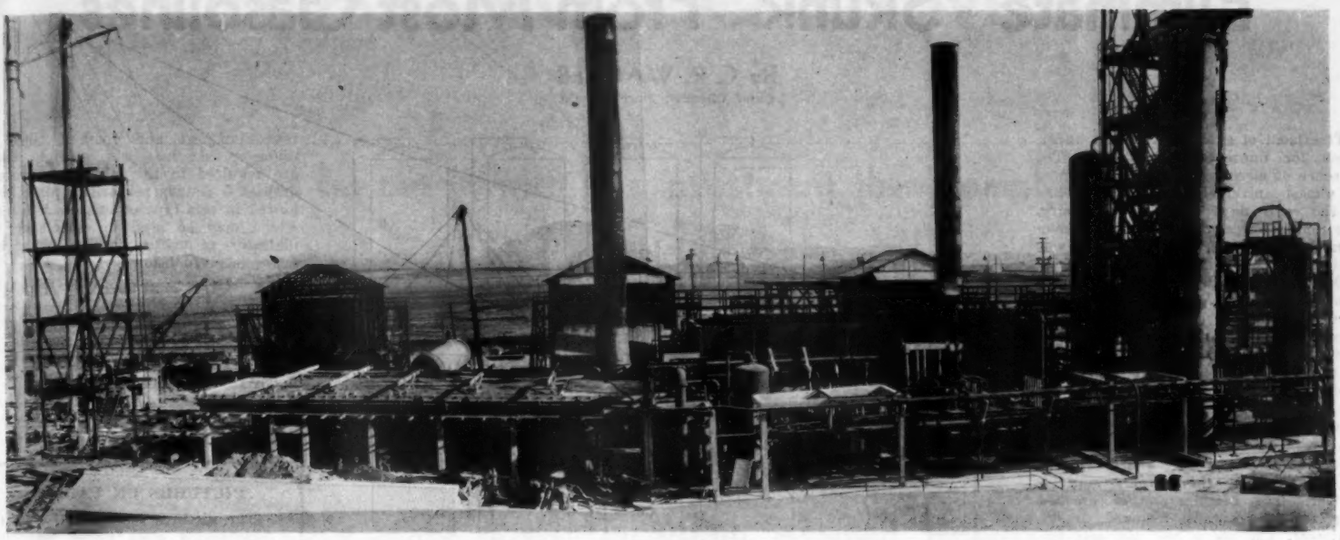
and TAILOR-MADE for EACH STATE

THE ANNUAL REFINERY NUMBER



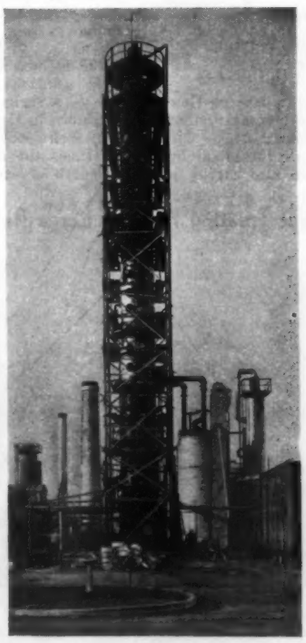
A 4,000-barrel cracking unit now being built at California refinery adjoining facilities of similar capacity completed last year

"We believe that now is the time when improvements may wisely be undertaken: first, because they will reduce costs; second, because never within 15 years could work be done so inexpensively; third, because every competitive business must keep in the front in methods and equipment in order to give consumers the lowest possible price, thus stimulating consumption; and fourth, because such improvements provide work and help improve general conditions."
—Recent statement to stockholders by the executive head of a major refining company.

THIS refining organization, like many others, has constantly improved and enlarged its plant facilities during the past three years. Last year it spent approximately $5,000,000 on its refineries and this year it has a program calling for an expenditure of $4,000,000 more.

This is concrete evidence that the refining branch of the oil industry is not standing still. Despite the many unfavorable factors during the past year the manufacturing division of the industry, as shown in the following pages, has pressed forward in its research and development departments with new ideas and new equipment.

Never before was it so necessary as now for the refiner to have up to date equipment which manufactures superior products at the lowest cost based on capacity in the history of the industry.



Seven by 120-foot tower under construction to fractionate 12,500 barrels of crude oil daily

To meet the demand of discriminating customers practically every product now has to meet predetermined specifications, which means it cannot simply be separated from the crude but must be an actually manufactured product.

The fact that the refining branch of the industry has been able to meet these requirements is a sufficient guarantee of its continuing expansion with old and new markets. Petroleum refining occupies the strongest position in its history.

No Expensive Processes or Reagents Needed to Eliminate "Skunk" From Most Gasolines

By C. R. WAGNER
Chief Chemist, Pure Oil Co.

Treatment of gasoline was first undertaken for improvement of odor. The presence of mercaptans, or "skunk," was an almost universal ailment of gasoline in the early days of the oil industry. The removal or conversion of these compounds by means of sodium plumbite was a simple matter until the Lima (Ohio) Field was discovered. Sulphuric acid treatment, among many other methods, was tried, and while it is possible to remove or oxidize mercaptans by such acid treatment, it was not until the development of the Frasch process that this Lima crude oil became of any particular value to the refiner.

With the development of cracking processes for manufacturing gasoline many new problems were added to those already troubling the refinery superintendent. The combination of cracked odor and mercaptans required drastic treatment. The use of 66° Be. acid followed by a caustic wash, redistillation and a final doctor treat was common practice. Clay treating was gradually substituted for acid treatment and as cracking became more widespread and as fractionation was improved, even this step was omitted. No matter how excellent the fractionation, mercaptans and hydrogen sulphide were not removed and the public has always objected to the smell of either.

An additional objection to the hydrogen sulphide was its corrosive nature, and, still worse, it oxidized readily with the formation of free sulphur. This free sulphur was soluble in the gasoline and could not be removed by simple washing with caustic soda, and it was even more corrosive than the hydrogen sulphide from which it originated.

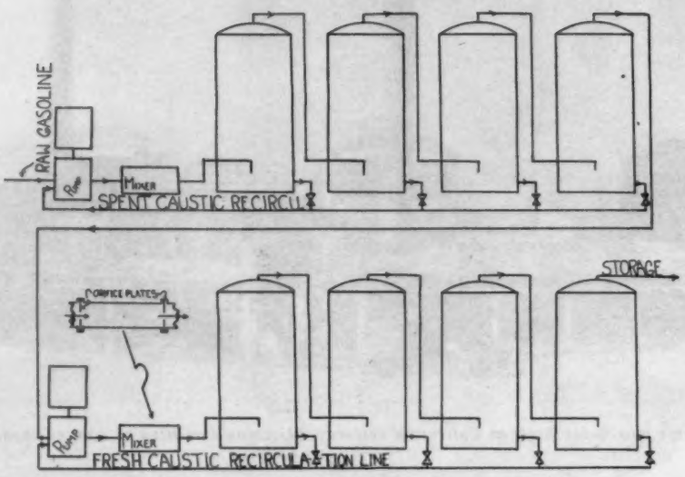
Double System Used

It has been found possible to treat the average gasoline in a satisfactory manner, however, and without the use of expensive processes or reagents. A double system involving suitable mixing nozzles and settling tanks is shown in the accompanying illustration. The raw gasoline is first treated with spent caustic soda containing at least 3 to 4 per cent by weight of sodium sulphide. This preliminary treatment accomplishes several things:

1. Most of the hydrogen sulphide is removed by the caustic remaining in the treating solution, thus increasing the concentration of sodium sulphide.
2. The free sulphur dissolved in the gasoline is absorbed by the sodium sulphide, forming sodium polysulphide.
3. Part or all of the mercaptans (depending upon the kind and concentration) are oxidized to disulphides by means of the sodium polysulphide.

A second treatment is given the gasoline, using fresh caustic soda of about 15° to 20° Be. This removes traces of hydrogen sulphide and sodium hydrogen sulphide carried over from the first operation. By the time the first treating solution has lost its effectiveness the second solution has picked up enough hydrogen sulphide to prove effective in removing free sulphur.

In some fields where repressuring of the oil sands is being done, difficulty is encountered due to the oxidation of hydrogen sulphide in the natural gasoline recovery systems. Free sulphur occurs in considerable quantity in the recovered gasoline and is not removed by caustic washing. Hypochlorite treatment of such gasoline gives a finished product containing sulphur chloride which hydrolyzes on light exposure or in contact with iron rust. Off-color corrosive gasoline is produced by this hydrolysis, a result that frequently does not transpire until after the gasoline has left the plant. A retained sample of the shipment kept in glass in the dark may still show perfect tests. The method of treating with spent caustic outlined is frequently sufficient not only to remove the free sulphur, but to effect complete sweetening as well.



Flow chart giving a diagrammatic representation of system for removing offensive odor from gasoline

Reactions in Removing Free Sulphur

The reactions involved in removing the free sulphur dissolved in the gasoline, and in the oxidation of certain mercaptans, may be stated as follows:

$$2NaOH + H_2S \rightarrow Na_2S + 2H_2O$$

$$Na_2S + S \rightarrow Na_2S_2 \text{ (sodium polysulphide)}$$

$$2R\,SH + Na_2S_x \rightarrow R_2S_2 + H_2S + Na_2S_{x-1}$$

Explanation of the accompanying flow chart, a diagrammatic representation of the treating system, follows:

Raw gasoline is fed into the mixer by means of a pump, which also carries a stream of spent caustic solution taken from a recirculating line leading from the bottoms of the three settling tanks in the first tier. The proportion of raw gasoline to spent caustic solution is roughly five parts of gasoline to one part of caustic solution. The gasoline and spent caustic solution mixture enters the successive settling tanks at a point near the bottom and leaves in an overhead stream. The overhead line from the last settling tank in the spent caustic solution tier leads to a second pump, which charges the spent caustic treated gasoline and fresh caustic solution into a second mixer and series of three settling tanks. Proportions in the mixture at this stage are likewise five parts of gasoline to one part of fresh caustic solution.

Efficient mixing of the gasoline and caustic solutions may be achieved by means of a series of orifice plates, such as is shown in the flow chart. The diameter of each spool should be not less than three times the diameter of the orifice. The length of each spool should be not less than two and one-half times its diameter. At least six or eight spools are required in the mixer. A pressure drop of 5 pounds per orifice plate is required in this type of mixer. A formula which may be used in calculating the diameter of orifice to use in such a mixer is given below:

$$Q\sqrt{N} = 37.998cA\sqrt{P/D}$$

Where:
Q = U. S. gallons per minute.
N = Number of plates.
c = Constant (0.65).
A = Area of orifice in sq. in.
P = Total pressure drop in lbs. per sq. in. through mixer.
D = Density of liquid.

Compact Treating Plant at Large Refinery

Treating plant of Pure Oil Co., showing double system employing suitable mixing nozzles and settling tanks

PICTURES ON PAGE 37

The pictures on page 37 depict construction work under way at two California refineries.

The large pictures show a 4,000-bbl. cracking unit under construction at the Avon, Calif., refinery of the Associated Oil Co. The new unit is to be operated in connection with a 10,000-bbl. viscosity breaker and a 4,000-bbl. cracking unit which was built a year ago. Construction work is in charge of E. B. Badger & Sons Co.

The smaller picture shows a mammoth tower now being built at the Long Beach, Calif., refinery of the Hancock Oil Co. by the Southwestern Engineering Corp.

The executive quoted on page 37 is J. Howard Pew, president of the Sun Oil Co.

RAILROADS LARGE CONSUMERS

The railroad companies in the United States are important purchasers of refinery products, the annual cost being in excess of $50,000,000. Purchases of fuel oil represent the largest single item but in the more recent years, gasoline is gaining in importance due to motorizing short lines. The following data showing such purchases have been prepared by the Interstate Commerce Commission and apply to all Class 1 roads:

PURCHASES OF FUEL OIL AND GASOLINE BY CLASS 1 RAILROADS

	Fuel Oil Gallons	Total cost*
1927	2,931,318,493	$81,909,242
1928	2,846,867,071	79,039,457
1929	3,207,774,722	87,281,015
1930	2,869,955,627	56,998,476
1931	2,330,331,738	40,737,709
	Gasoline Gallons	Total cost*
1927	14,552,303	$1,714,862
1928	20,812,173	2,343,880
1929	28,587,746	3,167,881
1930	34,344,936	3,380,731
1931	36,914,163	2,575,255

*Including transportation charges paid foreign lines.

The railway industry also uses a large quantity of lubricating oils and grease, illuminating oils and other petroleum products. Statistics showing the exact extent of that usage are not available. An indication of the cost of such items to the railways may be obtained from the following figures, which show the aggregate amount of purchases by Class 1 railways for lubricating oils and grease, illuminating oils, boiler compound and waste.

Year—	Amount
1927	$23,280,000
1928	23,968,000
1929	24,328,000
1930	13,200,000
1931	12,200,000
1932	13,200,000

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Can be put in with less investment than complete equipment and additional tankage required for acid treating; and at much less cost than a rerun still.

Operating costs, including a small royalty; and considering sludge, polymerization and octane number losses, are very much lower.

The LACHMAN-TREATED finished cracked gasoline is a superior product. The Sales Department, the Jobber and the Motorist will like it.

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LONDON, ENGLAND

Record Number of Operating Refineries in United States Despite Reductions in Runs to Stills

By C. O. WILLSON

More refineries are in operation in the United States at this time than any previous period in the history of the petroleum industry.

This situation is revealed in The Oil and Gas Journal's 1933 Annual Refinery Survey completed as of March 15 showing 424 operating plants with a daily crude oil capacity of 3,696,410 bbls. This total compares with 383 plants of 3,665,830-bbl. capacity in operation on the same date in 1932. The number of active plants at this time exceeds by 27 the previous record of 397 in March, 1931, when the rated capacity of operating plants was approximately 200,000 bbls. greater.

The gain in number of operating plants following a decrease the previous year is largely due to the building of temporary skimming plants, most of which are located in the East Texas area. However, there were a few new plants built at scattered points which incorporate modern features in refinery design and are permanent additions to the manufacturing division of the petroleum industry.

Large Gain in Texas

A year ago Texas had 89 operating refineries and this year's survey, published complete in this issue, shows 120 plants. Most of these new plants were built in the East Texas Field but there were several small plants constructed in other sections of the State and there were also a few old plants which resumed operations. In Oklahoma the number of operating plants increased from 41 to 47, Kansas 15 to 19, Pennsylvania 40 to 42, Montana 16 to 18 and Wyoming 12 to 14. A detailed comparison of the operating data for these States last year and this year will show that most of the new refineries are of small capacity and their owners obviously do not expect to operate them permanently.

In East Texas there are now over 30 operating plants, an increase of 20 for the year. Most of these plants have a daily skimming capacity of 1,000 bbls. or less. As in the case of Oklahoma City, the construction of these plants is to a large extent due to an unsatisfactory crude oil situation. The desire of producers to secure outlets for additional crude oil and the inability of states to adequately enforce their proration rulings resulted in surplus crude oil being available under the posted prices and this oil has been purchased by many of the local refineries. This situation has become acute over the past few months and has resulted in the construction of a large number of new plants in East Texas.

In Oklahoma City no new plants have been built recently. In that field there are 10 plants, all of the skimming type with one exception. Most of these plants have been shut down part time over the past three years but it so happens that eight were in operation on March 15 and for that reason are carried on the active list in this year's survey. In Montana and Wyoming more skimming plants were in operation than a year ago. In the latter State there are half a dozen plants which operate part time. They are usually operated because owners of production in small pools were unable to arrange for the purchase of their crude oil output by large buyers.

Permanent Plants

In Kansas the situation differed from that of Texas and Oklahoma. Two new refineries were built, a third is under construction and an old plant was reconditioned and reopened. The two plants are well balanced skimming and cracking plants and were designed for permanent operation. Although the inability to secure outlets for crude oil was a factor in the decision of the owners to build, the plants were not erected to tide over a temporary condition, the owners expecting to have permanent supplies of crude oil after the flush production of adjoining fields has been absorbed. In this connection these new Kansas plants also reflect a condition which may have greater significance over the coming year than it has in the past. In new construction it is now possible to install practically all phases of refinery equipment with capital investments based on capacity substantially less than the prevailing costs of two to five years ago. In general, the operating costs of the new equipment is also much less and quality of products improved. The net result is to place the new plants in a strong position in competing with old plants. This situation with a return to more normal conditions in the oil business could easily result in the construction of many new plants or complete rehabilitation of old plants which are now handicapped with obsolete equipment.

Conditions in East Texas reflected the inevitable development of uncontrolled supplies of crude oil in excess of the requirements of current refining and marketing requirements. The situation that has developed over the past year is not unlike that during the World War and the first few years following, although the causes differ.

During the war and immediately following, refinery operations were highly profitable. There was a large increase in the demand, both foreign and domestic, for gasoline and most of the other refined products. Posted crude oil prices were relatively low and there was a wide margin of operation to refiners regardless of location. The result was the construction of a large number of refineries throughout the Mid-Continent and to a lesser extent in California. Most of these plants did not survive with a return to more normal conditions in the oil business although many of the plants now operating had their beginnings at that time. The mushroom period in refinery construction ended about 1922 and for several years few new plants were constructed although there was constant improvement and enlargement at many of the well established refineries.

The resumption of new plant construction over the past two years has been due to conditions in the crude oil producing end of the oil business rather than the marketing division. In the latter the refiners have been faced with the lowest tank car and consumer prices since petroleum became a major industry. Added to this there has been a decreasing demand for most products reflected in the crude oil runs to stills at refineries which averaged more than 2,700,000 bbls. daily in 1929 with a drop to approximately 2,200,000 bbls. over the past year. In the face of this decreased demand available supplies of crude oil reached new peaks. With a restricted demand from established refiners, new plants have been built to furnish additional outlets. In many cases as previously explained these supplies represented crude produced in violation of proration orders and practically all of it has been run to stills with the main idea of large volume with no regard to whether or not there were outlets available at prices which would permit a profit to the entire industry.

This situation, which is already well known to everybody connected with the refining industry, has significance from several angles as regards the future of refining. It has demonstrated again that new refinery outlets will be quickly constructed whenever there is a substantial quantity of crude oil available in excess of the requirements of plants which are considered permanent units of the oil industry. Ultimately these new plants establish the markets of the industry starting with the price paid the producer for the raw material and extending through the wholesale and retail markets. If continued long enough these new plants will force out the weakest of the older plants.

Refiners Strengthen Position

The older plants, however, have not stood still during this period and this fact has greater significance of a permanent nature than does the building of 30 or more temporary plants. To meet the competition of companies operating with underpriced crude oil, the older operators have been forced to place their houses in order and in so doing as a unit they are in a stronger position today than any previous period in their history, a development which will be readily apparent with a return to normal conditions in the oil business.

They are meeting the low-priced situation in three ways. In the first place they have improved their manufacturing facilities. Obsolete equipment is being junked and along with it, the equally antiquated operating methods have been dropped. Those familiar with operating detail have been amazed with the results obtained. Articles appearing elsewhere in this Annual Refinery Number reflect the progress being made along technical lines in plant facilities and operating

TABLE 1—1933—REFINING CAPACITY IN THE UNITED STATES; RECAPITULATION BY STATES
(Capacities given in barrels daily) March 15, 1933

State—	No. of plants	Daily crude capacities	Plants operating	Capacity operating plants	Shutdown plants	Capacity shutdown refineries	Operating plants with cracking facilities	Cracking capacities
Alabama	1	6,000	...	.....	1	6,000	...	.....
Arizona	1	1,000	...	.....	1	1,000	...	.....
Arkansas	11	51,000	8	44,500	3	6,500	5	13,500
California	81	951,650	49	853,250	32	98,400	15	223,800
Colorado	6	7,400	6	7,400	...	.....	3	4,000
Georgia	2	9,000	2	9,000	...	.....	1	3,600
Illinois	13	141,900	10	132,200	3	9,700	7	84,100
Indiana	7	200,100	5	197,000	2	3,100	5	127,000
Iowa	1	1,500	...	.....	1	1,500	...	.....
Kansas	21	161,000	19	157,000	2	4,000	17	81,300
Kentucky	15	36,250	11	27,350	4	8,900	6	12,700
Louisiana	16	230,400	12	86,000	4	44,400	5	74,400
Maryland	4	57,000	3	50,000	1	7,000	2	59,572
Massachusetts	2	48,000	2	48,000	...	.....	2	30,300
Michigan	7	22,000	5	18,500	2	3,500	1	6,600
Missouri	3	23,000	3	23,000	...	.....	2	16,000
Montana	23	31,600	18	23,850	5	7,750	4	4,700
New Jersey	10	319,000	9	314,000	1	5,000	7	244,285
New Mexico	10	9,600	7	5,300	3	4,300	1	250
New York	5	55,500	5	55,500	...	.....	4	22,000
Ohio	17	101,190	15	99,190	2	2,000	10	58,400
Oklahoma	67	356,770	47	295,370	20	61,400	26	116,450
Pennsylvania	50	257,200	42	246,350	8	10,850	15	118,500
Rhode Island	2	11,500	2	11,500	...	.....	1	6,000
South Carolina	1	6,000	1	6,000	...	.....	...	.....
Tennessee	2	1,000	...	.....	2	1,000	...	.....
Texas	157	948,825	120	816,675	37	132,150	46	447,550
Utah	4	8,750	2	7,500	2	1,250	2	9,500
Virginia	1	1,500	1	1,500	...	.....	...	.....
Washington	2	1,500	...	.....	2	1,500	...	.....
West Virginia	6	16,750	6	16,750	...	.....	5	18,964
Wyoming	18	51,365	14	43,725	5	7,640	6	40,050
Total	567	4,125,250	424	3,696,410	143	428,840	198	1,823,521

methods. This trend is certain to carry on until entirely new standards are established in manufacturing operations.

The second development, which is closely tied in with the first, is the improvement in quality of products. Unable to compete in costs with the temporary plants operating with cheap crude, the permanent plants are constantly making their products more attractive to consumers with improved quality.

While skimming plants operating with suitable crudes still produce refined products for which consumer outlets can be found, they usually are not comparable in specifications with products obtained from refineries with modern equipment. In the case of gasoline the trend toward higher antiknock and more volatile motor fuels to meet the demands of manufacturers and owners of new motor cars continues. To keep pace with this trend it is becoming more and more important that refiners have well-balanced cracking facilities. Although the production of cracked gasoline over the past year showed a slight decrease for the first time in the history of the refining industry the loss was not as great as in the case of straightrun gasoline and natural gasoline. It is also true that to make their cracked gasolines more volatile and of higher octane value some refiners have found it necessary to reduce their percentage plant yields and this has been a contributing factor in the reduced total production. However, a large part of the decrease is no doubt due to the fact that cracking units at several refineries have been shut down permanently. The day is past in petroleum refining when it can be assumed that because a refinery has facilities for high temperature and pressure distillation, that it has adequate cracking facilities. Old cracking equipment at refineries is becoming obsolete at a more rapid rate than any other phase of plant operation. Many refiners are finding it profitable to shut down their old units despite the fact that they could still be operated and install equipment of greater capacity, small capital investment, lower fuel costs and a much reduced labor cost coupled with improved quality in products.

In addition to gasoline the art of cracking makes it possible to refine products not obtainable from ordinary skimming operations. Over the past six months there has been a relatively strong market for low cold test furnace oils, gas oils and all grades of fuel oils. In skimming plant operations the heavier overhead products and the residual products are usually so high in cold test that they have a limited market until they are further processed. This is illustrated in in the case of East Texas and Oklahoma City Fields where the heavier fractions of the crude oil have been sold at ridiculously low prices except in the few cases where cracking units have been installed. In addition there is an increasing number of specialty products now being produced at plants which have the necessary facilities which promise to become an increasingly important factor in the permanent refinery operations.

The third and final method being used by refiners to meet the low-priced competition of temporary plants has to do with reduced transportation costs. At many consuming points in the United States the cost of transportation from the refinery is greater than the refinery price for the products. Thus if a refiner can reduce a part of this transportation cost he has an important advantage over competitors. These reductions are being accomplished through the building of plants near the consuming points, expansion of crude oil and gasoline pipe line systems, greater use of water in transportation and expansion of trucking in delivery of finished products.

Changes in Operations

The only plant to be built in the East during the past year was a 15,000-bbl. topping plant by the Gulf Refining Co. on Staten Island, N. Y. In the Mount Pleasant Field of Michigan the Pure Oil Co. built a plant largely devoted to the production of specialty products. As the new year started the Mexican Petroleum Co. (Pan American) had completed plans for completely rebuilding its plant at Baltimore, Md.

Although the past year was not favorable from the standpoint of profits, there were few shutdowns of permanent nature among the older plants. Some were operating only a small fraction of their capacity but personnel was being retained in expectation of normal operations later.

RECAPITULATION

TABLE 2—GROWTH IN PETROLEUM REFINING (1914-1933)

Year—	Total number of refineries	Total crude capacity bbls. daily	Number of operating refineries	Capacity operating refineries bbls. daily	Number refineries with cracking processes*	Cracking capacities bbls. daily*
1914	176	.....	...	.....	...	.....
1918	267	1,186,155	...	.....	...	.....
1919	289	1,295,115	...	.....	...	.....
1920	373	1,530,565	...	.....	...	.....
1921	415	1,888,800	...	.....	...	.....
1922	479	2,164,050	325	1,854,590	...	.....
1924	574	3,046,790	362	2,549,490	...	.....
1925	584	3,033,682	385	2,680,052	(†)	(†)
1926	515	3,068,340	356	2,770,340	150	980,960
1927	462	3,224,307	328	2,964,427	158	1,245,890
1928	456	3,426,330	315	3,116,930	148	1,327,584
1929	463	3,719,550	341	3,454,250	170	1,487,950
1930	479	3,972,460	362	3,721,360	186	1,705,299
1931	500	4,164,080	397	3,913,180	208	1,844,609
1932	510	4,093,370	383	3,665,830	191	1,954,550
1933	567	4,125,250	424	3,696,410	198	‡1,823,521

*Operating refineries only. †Not available previous to 1926. Note: The reports from 1924-1933, inclusive, were compiled by The Oil and Gas Journal and the remainder by government bureaus. ‡In 1933 many refiners reported cracking capacity based on raw stock. In previous surveys cracking capacities included both raw and rerun stocks.

1933 Survey of Petroleum Refineries in United States

Abbreviations Used in Operating Data

Complete plant (Comp.)—Gasoline, kerosene, gas oil, fuel oil, lubricating oils, paraffin wax, petroleum coke, asphalt or both coke and asphalt, usually includes cracking. Some plants listed as complete do not manufacture asphalt or coke.

Skimming plants (S)—Gasoline, kerosene distillate, gas oil and fuel oil.

Skimming and lub (S&L)—Gasoline, kerosene distillate, gas oil, fuel oil and lubricating oils.

Skimming and asphalt (S&A)—Gasoline, kerosene distillate, gas oil, fuel oil and asphalt.

Skimming, lub and asphalt (SL&A)—Gasoline, kerosene distillate, gas oil, fuel oil, lubricating oils and asphalt.

Asphalt plant (A)—Distillates, gas oil, fuel oil and asphalt.

Topping plant (T)—Tops, distillates, gas oil and fuel oil.

Cracking (C)—Same products as skimming.

Lub plant (L)—Gas oil, fuel oil and lubricating oils.

Wax—No separate listing for wax is given in this year's survey. Refiners having lubricating plants in most cases manufacture wax.

ARKANSAS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Berry Asphalt Co., Waterloo	2,000	.....	A-L	
Henry H. Cross Co., Smackover	6,000	.....	S	
Kettle Creek Ref. Co., El Dorado	5,000	2,000	S-C	Dubbs
Lion Oil Ref. Co., El Dorado	12,000	3,500	S-C-A	Burton, Clark
Macmillan Pet. Prod. Co., Norphlet	2,500	.....	S-L	
Ouachita Valley Ref. Co., El Dorado	2,000	1,000	S-C	Vapor Phase
Root Ref. Co., El Dorado	12,000	5,000	S-C	Dubbs, Root
Simms Oil Co., Smackover	3,000	2,000	S-C	Cross
Total	44,500	13,500		

CALIFORNIA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Andrews, Wm. P., Oil Co., Long Beach	2,000	.....	S	
Andrews, Wm. P., Oil Co., Newhall	2,000	.....	S-A	
Associated Oil Co., Associated	50,000	18,000	Comp.	Tube and Tank
Associated Oil Co., Wilmington	18,000	.....	S	
Bush, R. R., Oil Co., Long Beach	3,000	.....	S	
Caminol Co., Ltd., Santa Fe Springs	4,500	.....	S	
Caminol Co., Ltd., Hanford	2,500	.....	S	
Casmite Co., Casmalia	1,000	.....	A	
Edington Witz Ref. Co., Long Beach	4,000	.....	S	
Estado Pet. Corp., Ltd., Long Beach	5,000	.....	S	
Exeter Oil Co., Ltd., Long Beach	6,500	.....	S	
General Pet. Corp., Vernon	50,000	.....	S-L	
General Pet. Corp., Torrance	35,000	10,000	S-C	Cross
General Pet. Corp., Lebec	12,000	.....	S	
Gilmore Oil Co., Ltd., Los Angeles	2,500	.....	S-A	
Gilmore Oil Co., Ltd., Orcutt	700	.....	S	
Hancock Oil Co., Long Beach	15,000	2,500	S-C	Vapor Phase
Lake View Oil & Ref. Co., Maricopa	3,000	.....	S	
Macmillan Pet. Corp., Long Beach	7,500	.....	S	
Mohawk Pet. Co., Bakersfield	3,000	.....	S	

CALIFORNIA (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Monarch Refineries, Venice	3,000	.....	S	
Norwalk Co., Maricopa	2,500	.....	S	
Olympic Ref. Co., Long Beach	5,500	.....	S	
McCallen, M. M., Ref. Co., Huntington Beach	400	.....	A	
Paraffine Co., Inc., Emeryville	1,200	.....	A	
Petrol Corp., Los Angeles	6,500	.....	S-A	
Pioneer Paper Co., Vernon	700	.....	A	
Richfield Oil Co., Watson	50,000	16,000	Comp.	Black
Richfield Oil Co., Hynes	55,000	14,000	S-C	Cross
Rio Grande Oil Co., South Gate	10,000	2,000	S-C	Jenkins
Seaside Oil Co., Ventura	5,000	.....	S-A	
Seaside Oil Co., Summerland	2,000	.....	A	
Shell Oil Co., Wilmington	58,000	18,400	S-C	Dubbs
Shell Oil Co., Martinez	36,500	21,000	Comp.	Dubbs, Shell
Shell Oil Co., Coalinga	4,200	.....	S	
Shell Oil Co., Dominguez	.....	34,000	C	Dubbs
Standard Oil Co. of Calif., Richmond	100,000	18,200	Comp.	Richmond
Standard Oil Co. of Calif., El Segundo	100,000	36,300	Comp.	Modified Richmond
Standard Oil Co. of Calif., Bakersfield	25,000	.....	S-A	
St. Helens Pet. Co., Ltd., Nea Pico (Los Angeles County)	5,000	.....	S	
Terra Bella Ref. Co., Ltd., Terra Bella	400	.....	L	
The Texas Co. (Calif.), Los Angeles	30,000	5,500	Comp.	Holmes-Manley
The Texas Co. (Calif.), Fillmore	4,000	2,700	S-C	Cross
Triangle Oil & Ref. Co., Venice	250	.....	S	
Union Oil Co. (Calif.)(Wilmington	55,000	21,000	S-C-A	Cross
Union Oil Co. (Calif), Oleum	30,000	.....	S-A-L	
Union Oil Co. (Calif.), Bakersfield	5,000	.....	S	
Union Oil Co. (Calif.), Santa Paula	900	.....	S	
Western Oil & Ref. Co., Wilmington	12,000	4,200	S-C	Jenkins
Wilshire Oil Co., Vernon	20,000	.....	S	
Total	855,250	223,800		

COLORADO

Continental Oil Co., Florence	3,000	1,500	S-C	Burton
Continental Oil Co., Denver	1,500	1,000	S-C	Cross
Midland Oil Ref. Co., Denver	1,500	.....	S	
Mountain States Ref. Co., Orchard	200	.....	S	
The Texas Company, Craig	1,000	1,500	S-C	Holmes-Manley
Raven Oil & Ref. Co., Rangely	200	.....	S	
Total	7,400	4,000		

GEORGIA

Atlantic Ref. Co., Brunswick	5,000	3,600	Comp.	Lewis
Mexican Pet. Corp. (Georgia), Savannah	4,000	.....	A	
Total	9,000	3,600		

(Continued on Page 78)

OIL BOOTLEGGING

Cross-section of funnel showing cutting knives.

SEALED CONTAINERS PREVENT SUBSTITUTION AND ADULTERATION *but THATS ONLY HALF PROTECTION*

•

THIS *New* CUTTING AND DISPENSING *FUNNEL*

Makes it physically impossible to trap oil or give short-measure

STOPPED!

Bootleggers are just as much a menace to the Oil Industry as they have been to the 18th Amendment, and the measures heretofore adopted to stop the oil bootlegger, while numerous and expensive, have been sorely ineffective.

There is only one way to stop oil bootleggers, and that is to make it physically impossible for them to operate.

When Continental developed the sealed, tamper-proof containers for Motor Oil, in quart and five quart sizes, that was a step forward to stop the oil bootlegger, for positive protection against substitution and adulteration was assured.

The next big obstacle to be overcome was to make it impossible to trap or steal oil, or short-measure the customer. So, a cutting and *rigid* dispensing funnel for the cans was developed by Continental.

With Continental's sealed tamper-proof cans, and cutting and dispensing funnels, the oil bootlegger is completely stopped. He can't operate. Experience proves that completely—it's past the testing age. If you want to make additional profits, and save gallonage, put this powerful new merchandising plan to work! Write, wire or phone for a representative to call.

You owe it to your honest filling station operator or dealer to protect him against the unscrupulous bootlegger.

CONTINENTAL CAN COMPANY, INC.

NEW YORK CITY, 100 East 42nd Street • Ashland 4-2300

CHICAGO
4622 West North Ave.
Spaulding 8480

WHEELING
Hazlett Ave. & 8th St.
Warwood 760

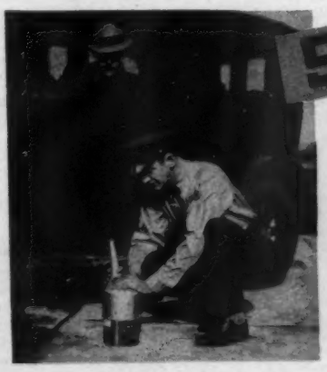
NEW ORLEANS
521 North Scott St.
Galvez 4145

LOS ANGELES
3820 Union Pacific Ave.
Angelus 7111

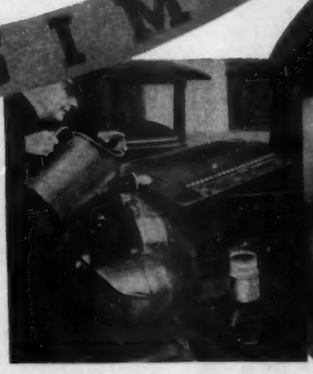
SAN FRANCISCO
155 Montgomery St.
Garfield 7890

KANSAS CITY
Guinotte & Lydia Aves.
Victor 7250

SIMPLE AS A.B.C.



The cutting knives of the funnel, forced over the can, quickly and easily open it in the presence of the purchaser.



With the rigid (not flexible) spout, the can is emptied in from 14 to 18 seconds and permits the service man to attend to gas, water, etc.

The tamper-proof can, when opened, has been rendered unfit for further use.

Economical Method of Removing Sludge From Light Oils Offered by Packed Coagulator

By HOWARD G. VESPER
Standard Oil Co. of California

One of the principal problems involved in the use of sulphuric acid as a refining agent is that of adequate acid sludge removal prior to processing. The deleterious effects on quality of incomplete sludge separation are well known. This problem will be discussed with particular relation to the treatment of light oils of the gasoline, cracked naphtha and kerosene groups.

Various means have been employed to accomplish the desired sludge separation after acid contacting, such as (1) settling in unpacked vessels, either vertical or horizontal, (2) water washing, (3) filtration through canvas or beds of fine sand, (4) centrifugal separation. These methods, however, either fall short of the goal of complete sludge removal, or involve other obvious limitations, such as batch operation, high initial expense, and excessive maintenance costs.

This paper discusses a novel method of overcoming these disadvantages at low initial and upkeep cost by the use of packed coagulators of suitable design.

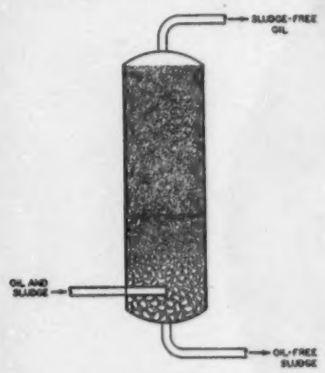


Figure 1

TABLE 1—AVERAGE OPERATING DATA, THREE-UNIT COAGULATING SYSTEM

Aver. grav. gaso. treated, °A.P.I.—	Feed rate (bbls. per hour)	Acid application: Kind	Acid application: Lbs. H_2SO_4 per 1,000 gallons of gasoline	Acidity of acid gasoline, lbs. H_2SO_4 per 1,000 gallons: Out of first coagulator	Acidity of acid gasoline, lbs. H_2SO_4 per 1,000 gallons: Out of second and third coagulators in parallel
56.1-63.2	600	87 per cent black*	10	0.58	0.15
58.6	700	87 per cent black*	10	0.59	0.175
56.3	1,000	87 per cent black*	10	0.65	0.175
57.8	500	87 per cent black*	20	0.53	0.14
51.3	950	87 per cent black*	20	0.84	0.275
55.6	700	87 per cent black*	40	0.68	0.21
57.8	500	87 per cent black*	50	0.51	0.19
55.6	600	87 per cent black*	50	0.56	0.26
55.3	600	95 per cent black*	25	0.40	0.21
55.4	1,000	95 per cent black*	25	0.52	0.235
55.0	800	15 per cent fuming	50	0.83	0.335
			Averages	0.61	0.21

*Recovered acid.

by sludge than by gasoline or kerosene; otherwise the greater portion of the sludge would remain suspended in the oil leaving the top of the unit.

"Coalescing" describes the operation of the packed unit better than "coagulating," but the latter is preferred as a more convenient term. From the above description, however, it will be clear that the operation of a packed coagulator is entirely distinct from filtration through a sand bed or other nonself-cleaning filter medium.

Figure 1 is a sketch showing the approximate design of a commercial coagulator unit for separating acid sludge from light oil. Note particularly the use of larger sized packing material in the lower portion of the vessel, as a means of (1) accomplishing separation of the large bulk of the sludge so that the finer packing material above may act more efficiently in coagulating the smaller sludge particles, which are the most difficult to remove, (2) distributing the incoming oil-sludge mix, and (3) supporting the remainder of the coagulator packing. The contacting of light oil and acid prior to this unit may be accomplished by any adequate mixing device.

Slection of Packing Material

Selection of the proper packing material is an important element of design. Common acid resistant materials which are preferentially wetted by sludge include quartz, granite and other rock high in silica content; and also various types of fused pottery and stoneware. Of these, ordinary commercial graded rock is preferred because of low cost and general availability. An example of an unsatisfactory packing is coal, which is more easily wetted by oil than by sludge.

The maximum possible surface area is desirable for the packing material in order to provide the greatest facilities for agglomeration of sludge particles and to allow the use of a unit of the smallest size consistent with the necessary sludge removal. Fine particle size is therefore desirable, since the active surface is much greater than for the same volume of coarse packing material. The minimum size, however, is limited by the increased fluid velocity resulting from reduction of the voids. An excessive fluid velocity would result in rupturing of the sludge film on the packing and would prevent the downward settling of coagulated drops of sludge. Further, too fine a packing material may give an excessive pressure drop by reducing the voids to such an extent that clogging is approached. The optimum size of packing material will also be influenced by the viscosity and nature of the liquids to be separated, and by interfacial tension relations between the sludge, oil and packing material.

After considerable experimental work with various packing materials, pea gravel and No. 4 crushed rock were chosen as the best available for removing finely divided sludge from acid-treated gasoline, naphtha and lamp oil. Of these, the No. 4 rock is generally preferred. Following are representative screen analyses:

	Pea gravel per cent	No. 4 crushed rock per cent
On ¾-in. screen	2.0	
On 2-mesh screen	5.8	10.8
On 4-mesh screen	36.6	68.2
On 10-mesh screen	49.9	19.4
Through 10-mesh screen	....	1.6
On 20-mesh screen	13.2	....
Through 20-mesh screen	1.5	....

Other satisfactory sludge coagulating materials for special uses are No. 3 rock, ranging in size between about one-quarter and three-quarter inches, and No. 2 rock, between about three-quarters and 1½ inches. No. 1 rock (1½ to 3 inches) and cobblestones (6 to 12 inches) are usually used for supporting the active coagulating beds.

In general, a packing material approaching uniform size is preferable to one of the same average particle size in which the sizes of the individual particles vary considerably.

General Design

The optimum dimensions of the coagulating bed for a given rate depend on the packing material, the nature of the fluids being separated, and the degree of separation desired. Commercial experience, examples of which are given later, has indicated that for design purposes a vertical coagulator packed with 16 feet of the above described pea gravel or No. 4 rock or equivalent may be assumed to give substantially complete removal of sludge from an average gasoline at rates up to about 10 bbls. per hour per square foot of superficial cross section. For separation of lamp oil sludge, the corresponding maximum figure is approximately 7.

Flow through the coagulating bed may be either vertical or horizontal, both types being in successful commercial use. An advantage of vertical coagulators is the assurance of even flow distribution through the packing material. Some unevenness of distribution is unavoidable when horizontal flow is used, as the voids in the lower part of the coagulator are partially closed by the downward draining of the separated sludge. Also, unless special precautions are taken, serious channeling may occur in a coagulator of the horizontal flow type due to the packing material settling and leaving a free space at the top of the shell. A further advantage of vertical flow is a lower installation cost due to the use of cobblestones, scrap pipe, or other material offering large voids to support the active coagulating bed and at the same time to provide an adequate sludge storage space.

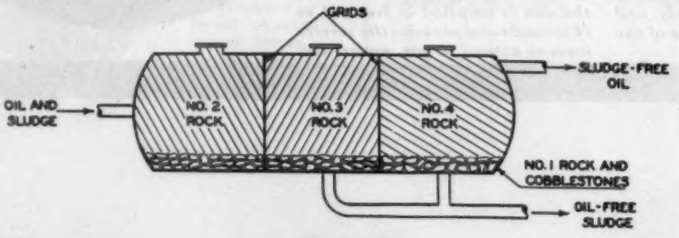


Figure 3

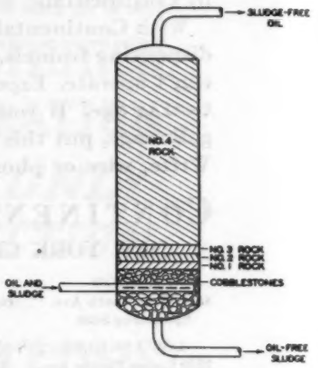


Figure 2

In horizontal units, screens or grids must be used to support the coagulating beds. Also, the superior sedimentation inherently obtained with horizontal flow as compared to vertical flow is of minor importance in packed units. It is therefore concluded that the vertical form of packed coagulator is to be generally preferred.

As implied above, the sludge settling and collecting space is usually in the bottom of the same shell used to hold the coagulating material, although a separate container may be used if desired.

Flow Should Be Uniform

In order efficiently to utilize the entire coagulating bed, the flow through it should be uniform. The gasoline-sludge mixture should therefore be introduced in such a way as to facilitate this. In vertical units, a preferred method is to run the inlet line directly into the coarse rock bed used to support the active coagulating material so as to insure even distribution before entering the coagulating bed. In this case, care must be taken to maintain the sludge level below the inlet line.

As will be readily apparent from the foregoing discussion of design features, the general principle of using packed coagulators for sludge removal from light oils may be successfully employed in various forms. Several units may be used in series or equivalent coagulation may be obtained in one vessel. Some other modifications are (1) the use of a free space between two coagulating beds in

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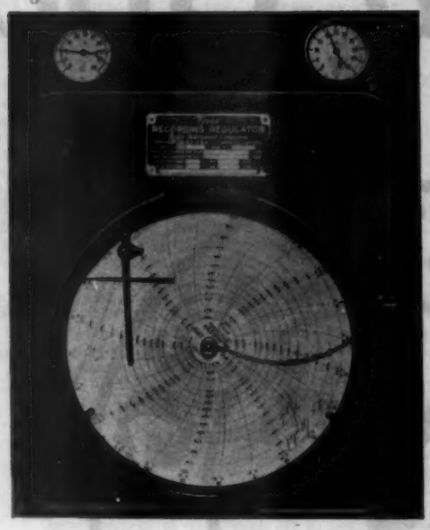
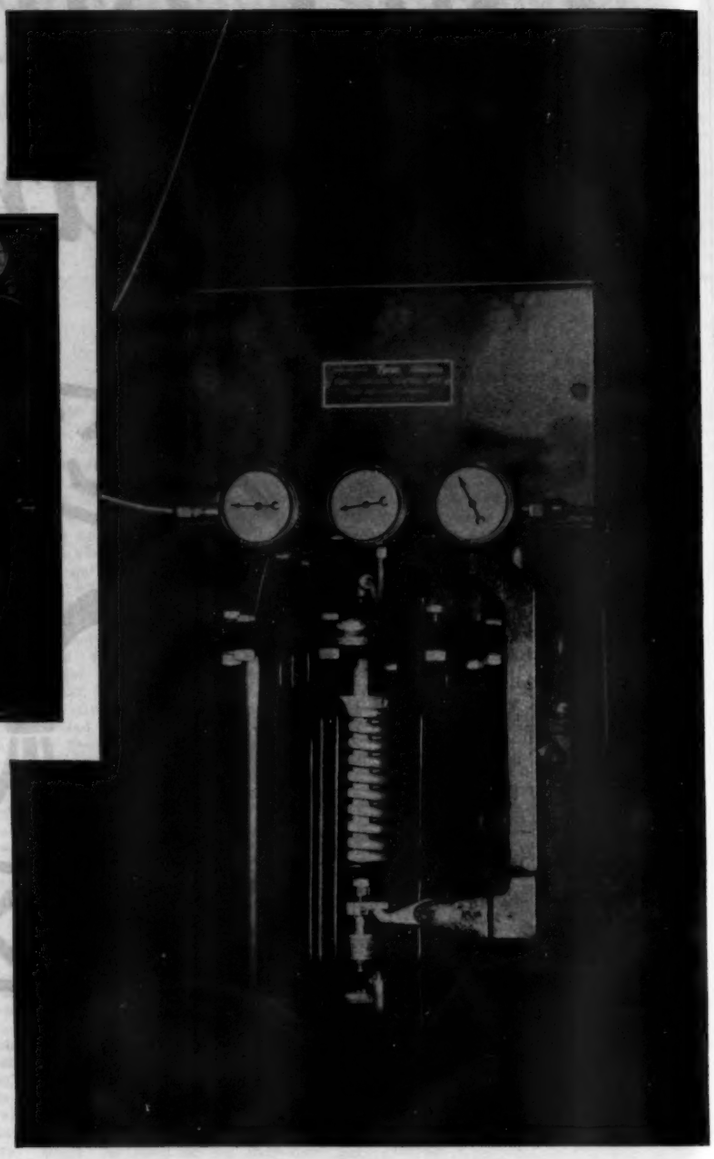
No more worry about load changes

NEW TAYLOR DUBL-RESPONSE REGULATOR MAINTAINS STRAIGHT-LINE CONTROL OF TEMPERATURE HOUR AFTER HOUR





No more worry about shifting control points • No more worry about hunting • No more worry about "sticky valve" action

Your load may be 1,000 gallons now and 5,000 gallons tomorrow morning—in spite of load changes and in spite of process time lag, you can maintain straight-line control of temperature with the new Taylor Dubl-Response Control.

The Dubl-Response Control Unit is used with Taylor Recording Regulators and Taylor Evenaction Diaphragm Valves. It assures control irrespective of stuffing box friction, eliminating "sticky valve" troubles—an exclusive feature.

"Hunting" or "over controlling" and shifting of control point are eliminated.

Sliding sensitivity adjustments can be made while the instrument is in operation to adapt its action to the speed of response and time lag of the stabilizer, tower or still. Its control is more precise than that of any other instrument.

Learn more about this new Taylor instrument for the petroleum industry. Let us send you our new Bulletin giving more details about its operation. Write to the Taylor Instrument Companies, Rochester, N. Y.

Here you see the Taylor Dubl-Response Regulator controlling top temperatures of a vacuum still at the large Bayonne, N. J., refinery of the Tide Water Oil Company. The System consists of a Recorder-Regulator (at the left) and the Dubl-Response Control Unit attached directly to a Taylor Evenaction Diaphragm valve in the steam line, to the reflux pump.

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order to reduce the velocity and allow separation of partially agglomerated sludge particles; (2) the use of a collecting device at an intermediate point in the coagulating unit to allow direct removal of sludge to the bottom without draining downward through the coagulating bed, thus relieving the lower portion of the bed of a considerable load.

Figures 2, 3 and 4 are diagrams illustrating typical commercial installations. Although Figure 4 shows the use of both a free space and an intermediate sludge drain in the same coagulator unit, it will be apparent that each of these modifications may be used separately if desired.

Commercial Operating Results

Table 1 shows actual data obtained recently over a period of months on various California straightrun stocks, using a two-stage coagulating system of the type shown in Figure 4 directly after the acid contacting step. The second coagulator stage consisted of two units in parallel both packed with the equivalent of 20 feet of No. 4 rock. All three coagulators were 10 feet in diameter and 30 feet high.

No data are shown in Table 1 for the acidity of the oil entering the coagulating system, because of the large variation in this figure with changing acid treating and feed rates, and correspondingly, in preliminary sludge separation. This separation is accomplished in the system described by removal of the bulk of the easily separated sludge from an unpacked vessel in which a portion of the acid-oil contacting is accomplished.

Table 1 shows the average acidity of the gasoline discharged from the second and third coagulators to be 0.21 pounds of sulphuric acid per 1,000 gallons. This is equivalent to an acidity reduction of well above 90 per cent through the coagulating system, of which about three-quarters was accomplished in the primary coagulating unit. This represents removal of practically all of the suspended sludge, the balance of the acidity being largely dissolved sulphur dioxide and acid reaction products. The stock leaving the coagulating system is bright in appearance and is ordinarily neutralized with caustic directly or may be water washed if desired with no quality reversion. Dry neutralization may also be satisfactorily employed.

Additional Points of Interest

The data in Table 1 indicate several additional points of interest, which are also substantiated by operating experience, especially on gasoline:

1. Although the acidity of the stock leaving the coagulating system tends to increase with increasing throughput rates, the variation is of limited practical significance up to the limit of coagulating capacity. The conditions shown in Table 1 are within this limit.

2. A corresponding conclusion is indicated for variation in acid treating rate, and hence, in acidity of the stock entering the coagulating system. The highest such acidity for the runs covered in Table 1 was 4.28 pounds of sulphuric acid per 1,000 gallons, but the same coagulating system has successfully handled stocks having acid contents over four times this high.

3. Acidities are higher throughout the coagulating system when 15 per cent fuming acid is used in treating, probably because of a higher content of dissolved sulphur dioxide.

The pressure drops through the three-unit coagulating system described are very low:

Feed rate (bbls. per hour)	Pressure drop through First coagulator	Pressure drop through Second and third coagulators in parallel
700	6¼ lbs./sq. in.	3¼ lbs./sq. in. ea.
1,000	11	6¾

Operating and Quality Advantages

Following are the principal quality and operating advantages gained by the use of a properly designed sludge coagulating system, such as that described above:

1. Elimination of water washing of acid gasoline containing sludge, with resultant color improvement. For equal color and color stability, acid or equivalent clay requirements are reduced by over one-half.

2. Elimination of corrosion due to acid water.

3. Removal of tendency toward emulsification during neutralizing.

4. Elimination of pink color occasionally encountered in treated gasoline.

5. Insurance of complete reaction between acid and gasoline by providing intimate contact in thin films over large surfaces.

6. Elimination of practically all oil from sludge leaving the system, thus facilitating acid recovery or sludge disposal.

In some cases it is advantageous to introduce previously separated sludge into the coagulating system as a means of insuring separation of entrained oil. This procedure is also desirable when processing a very low acid content stock through the coagulating system in order to insure an adequate reservoir of sludge.

In some cases, using recovered or "black" acid for treatment, certain carbonaceous material remains suspended in the oil after practically all of the acid sludge has been removed. Elimination of this carbonaceous matter is desirable to avoid the poor color stability which results if it remains in contact with the oil during the remainder of the treating process. This object may be accomplished by the use of a coagulating bed packed with fairly fine rock, following the acid sludge coagulating system.

The use of an adequate packed coagulating system on acid treated cracked naphtha or lamp oil gives results and advantages similar to those described above, and commercial installations are in successful use in both services.

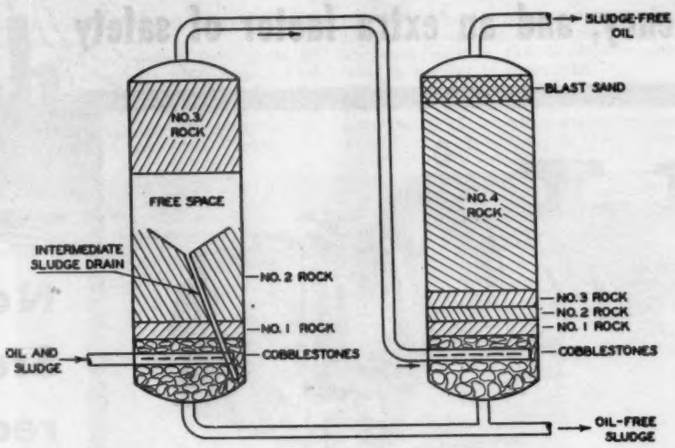

Figure 4

Other Applications

In some cases where water washing is still used prior to neutralization, the packed coagulator has another interesting application. A correctly packed unit will reduce the water content of the oil to a very low figure, thus accomplishing considerable saving in neutralizing costs. One commercial installation of this type reduced the caustic requirement to about 40 per cent of that required for direct neutralization of the water washed stock. A further advantage of this application is a material increase in plant capacity by elimination of emulsifying tendencies during neutralization.

Another similar use of packed coagulators is for removal from light oils of suspended caustic or other neutralizing material in water solution. By the use of a correctly designed unit a substantially bright gasoline may be produced directly following the neutralizing step.

The packed coagulator installations described are protected by issued patents and pending applications.

Maintenance

Packed coagulators as described require only negligible maintenance. For example, the first commercial unit of this type (as shown in Figure 2), using No. 4 rock for the bulk of the packing, operated almost continuously for more than two years without attention or repairs. During this period, over 10,000,000 bbls. of various grades of gasoline, containing widely different amounts of sludge, were processed successfully.

At the conclusion of this period the rock packing was found to be in perfect condition except for a coating of carbonaceous material. This was removed by salt water washing and steaming, followed by air to dry the rock, and the unit restored to its original efficiency at a cost of only $100 to $150. The frequency at which this procedure is necessary varies, of course, with the treating conditions, but it is so seldom as to warrant the statement that for all practical purposes packed coagulators require no maintenance.

Costs and Savings

For the acid sludge coagulator installations listed above, monetary savings result from:

1. Decreased acid (or clay) requirements for color.

2. Decreased caustic requirements for neutralizing.

3. Elimination of water washing, particularly on gasoline stocks (except where water washing equipment and a cheap water supply are available).

Where water washing is eliminated, a slight increase in yield is usually obtained as well, due to freedom from emulsion losses and loss of oil entrained in the wash water.

While these savings will vary in magnitude between different plants, they will generally total at least $2 to $3 per 1,000 bbls. of gasoline treated. In addition, differences in plant investment are striking. The following are roughly estimated costs for installing sludge removal equipment for a 10,000-bbl.-per-day treating plant:

Unpacked settler and water washer.	$23,000
Two packed coagulators in series....	5,000
Saving (in addition to operating economies)	$15,000

If open sludge settlers or other suitable equipment are available for conversion, the coagulator investment is even more attractive, since under these conditions the cost will ordinarily not exceed about $500 to $750 per coagulator unit.

Survey of Operating Refineries in Canada

Abbreviations: S—Skimming; C—Cracking; A—Asphalt; Comp.—Complete, includes all the principal products secured from petroleum.

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
ALBERTA				
Imperial Oil, Ltd., Calgary	5,000	3,800	Comp.	Tube & Tank
Bell Ref. Co., Ltd., Calgary	750	500	S-C	Vapor Phase
Lion Refining Co., Calgary	250	.....	S	
Maple Leaf Pet., Ltd., Coutts	5,000	.....	S	
Northwest Stellarene Co., Inc., Coutts	1,500	1,500	S-C	Dubbs
Regal Oil & Ref. Co., Calgary	3,000	.....	S	
Total	15,500	5,800		
BRITISH COLUMBIA				
Imperial Oil, Ltd., Ioco	16,000	3,600	Comp.	Tube & Tank
Home Oil Distributors, Ltd., North Vancouver	1,000	.....	S	
Shell Oil Co. of Canada, Ltd., Burnaby (Vancouver)	3,500	.....	S	
Total	20,500	3,600		
MANITOBA				
North Star Oil, Ltd., Winnipeg	500	.....	S	
Radio Refs., Winnipeg	1,000	.....	S	
Total	1,500	.....		
NOVA SCOTIA				
Imperial Oil, Ltd., Dartmouth	17,000	6,000	Comp.	Tube & Tank Burton
ONTARIO				
British-American Oil Co., Ltd., Toronto	8,000	3,000	S-C	British-American
British-American Oil Co., Ltd., Montreal	15,000	5,000	S-C	British-American
Canadian Oil Cos., Ltd., Petrolia	1,000	.....	S-L	
Imperial Oil, Ltd., Sarnia	22,000	14,600	Comp.	Tube & Tank
McColl-Frontenac Oil Co., Ltd., Toronto	5,000	3,200	S-C	Jenkins, Gyro
Simrall Ref. Corp., Amherstburg	2,500	.....	S	
Total	53,500	25,800		
QUEBEC				
Imperial Oil, Ltd., Montreal	30,000	8,000	Comp.	Tube & Tank
LaSalle Petroleum Co., Montreal	3,000	.....	S	
McColl-Frontenac Oil Co., Ltd., Montreal	5,000	3,200	S-C	Jenkins, Gyro
Shell Oil Co. of Canada, Ltd., Montreal	3,500	3,000	S-C	Dubbs
Total	41,500	14,200		
SASKATCHEWAN				
Crow Oil Co., Ltd., Weyburn*	300	.....	S	
Imperial Oil, Ltd., Regina	7,200	4,500	Comp.	Tube & Tank, Burton
Karels Oil Refinery, Regina	175	.....	S	
Sterling Oil Refs., Ltd., Moose Jaw	700	400	S-C	Sterling
Total	8,375	4,900		

*Plant under construction, March 15, 1933.

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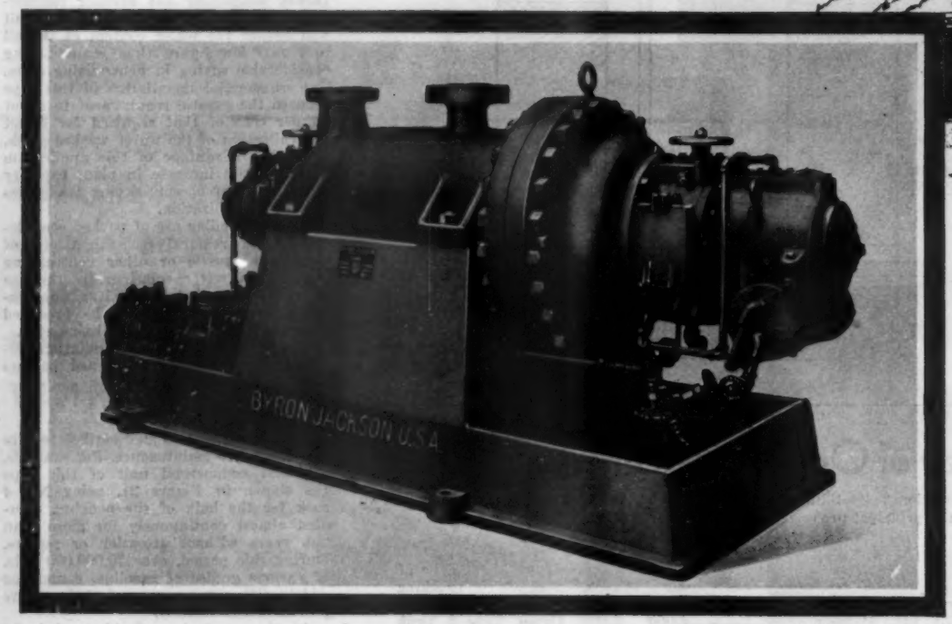

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Continental Installs Ultra-Modern Electric Power Switching Equipment at Ponca City Refinery

By W. T. ZIEGENHAIN

The Continental Oil Co. has just completed the installation of an electric power switching equipment at its Ponca City, Okla., refinery that includes several unique features. This installation provides extreme flexibility in co-ordinating the operation of the local power plant with that of the local public utility company, which also serves the refinery. It provides maximum safety for the operator, is as near "fool proof" as practicable and has been installed in a manner which guarantees permanency in itself, and permits subsequent refinery expansion at a relatively low added cost for power control.

The refinery is now served by two sources of electricity, one the plant power house and the other the local public service company lines. For contractual reasons the Continental Oil Co. takes some current from the utility company lines at all times. However, the quantity may be varied within a wide range to handle changing refinery loads and to offer smooth and economical operation in the refinery power plant. Such a joint power system is coming into general use among refineries since it is a strong guarantee of continuous power for the operation of the plant under any emergency. The method of correlating the operation of these two sources at the Continental plant will be briefly described here.

Refinery Power Plant

The refinery power plant houses two 1,000 k.w. and three 500 k.w. turbo-generators. The turbines are supplied with 165-pound steam, the two 1,000 k.w. Kerr turbines being of the bleeding type and permit taking off 40-pound steam for refinery processing. The balance of the steam from these units goes to a surface condenser which provides a reduced back pressure of 28 inches of vacuum. One of the 500 General Electric turbines operates against a 10-pound exhaust which is led back to the steam plant for heating the feed water and the other two 500 General Electric turbines operate against a 26-inch vacuum through jet condensers.

All generators produce three phase, 60 cycle A.C. current at 2,300 volts and all feed into a common system for plant distribution of power. The current coming to the refinery from the public service lines is stepped down from 66,000 volts to 2,300 volts for plant distribution so that the operations of the two sources of power may be tied in directly and used in parallel or separately.

At one end of the power house Continental has just installed an ultra-modern switchboard. Here all circuits are arranged so that power may be taken either from the local refinery plant or from the public service lines, by use of disconnecting switches.

The plant load is carried through eight substations scattered throughout the refinery, each of which is tied into two identical systems of bus bars at this switchboard. Also, each of the generators is tied into each of these two systems of buses. Thus, the switchboard provides extreme flexibility in allocating any load to either power source.

The board itself is of the cubical, all-enclosed General Electric type. Safety in its operation has been made a paramount consideration. A key locks each of the oil switches so that before an operator may pull the switch he must first insert a key in the lock and turn the lock. This trips out the oil circuit breaker on that particular panel and with the circuit broken, the operator may then pull the disconnecting switch. He is similarly protected in throwing the switch in.

The oil switch is so installed in each cubical as to permit its removal from the front without a service interruption. Permanent lines have been placed in each panel to by-pass each of these oil switches and to remove a switch for repair or for replacement simply calls for by-passing the load and lifting the switch out of its frame.

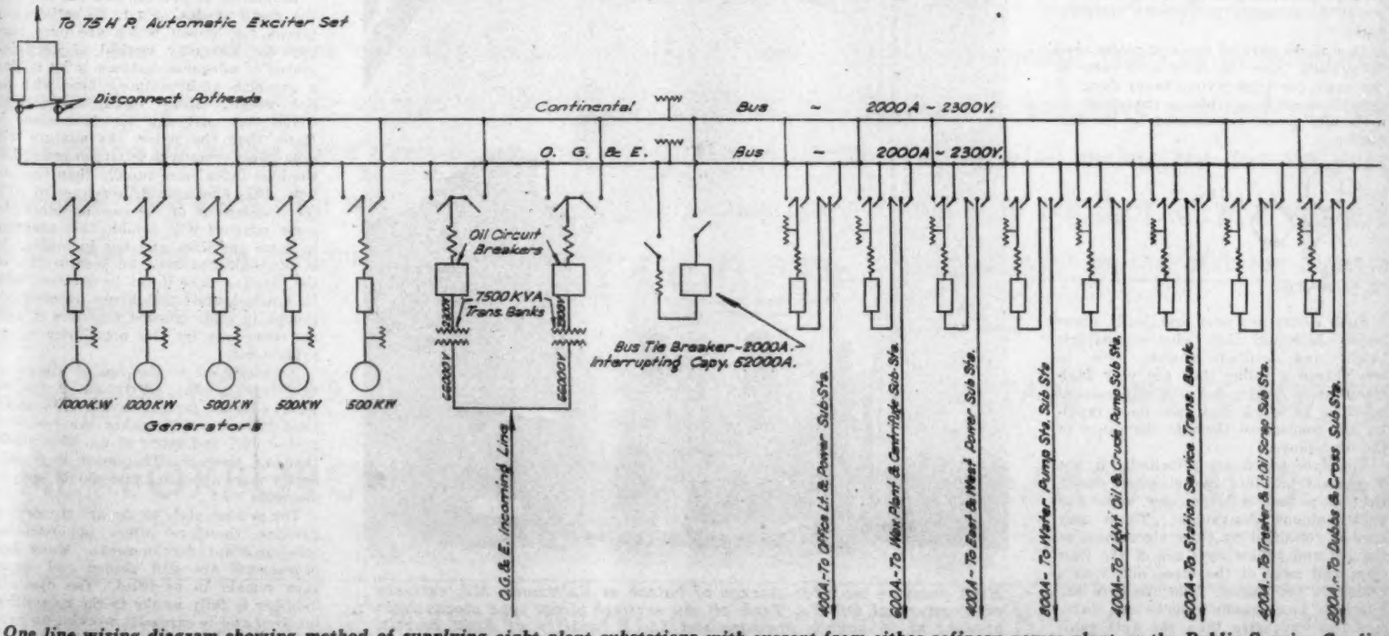
General view of Continental Oil Co.'s power plant at Ponca City, Oklahoma refinery. The new Cubical type, all-enclosed switchboard in the background provides maximum safety and flexibility in operation

Refinery Load

The refinery load approximates 3,500 k.w.h. and the peak load approximates 7,500 k.w.h. Because some current is constantly supplied by the public service lines, and because of the preponderance of the power available from that source, it has been found practical to allocate substation loads to that source and other stations to the refinery power plant. Thus the loads on the eight substations are divided as desired. This does not mean, however, that it is not convenient to operate the two power sources in parallel, but simply that this latter method of operation is not generally favored.

The accompanying one-line diagram

(Continued on Page 76)



One line wiring diagram showing method of supplying eight plant substations with current from either refinery power plant or the Public Service Co. lines

Manufacture of Colored Gasolines Requires Use of Dyes of High Solubility and Fastness

By DR. R. G. CLARKSON
E. I. du Pont de Nemours & Co.

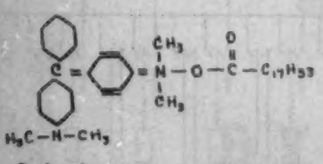
In these days, when even our bathrooms and the sheets on our beds are decked in bright and vivid colors, we have grown to demand that our motor fuel shall be other than an uninteresting so-called "water white." This fashion has its uses in the gasoline trade in that it permits distinctive marking of the various brands. It serves to protect the public from any unscrupulous retailer who attempts to deliver all brands of gasoline from the same storage tank. It helps the refiner by making it more difficult to adulterate standard grades of gasoline with a poorer quality.

The situation has created a new demand upon the dyestuff industry for dyes of high solubility and considerable fastness to light in gasoline. One would ordinarily think that this should create no difficulty since, of all the vast numbers of dyes in use, some should fulfill these requirements. This is not true for two reasons. The first is that most dyes are water soluble and it is a fairly general rule that those dyes which are soluble in water are insoluble in gasoline and vice versa. The second reason is that many dyes which are light fast on cloth or in benzol solution are extremely fugitive in gasoline. The problem is therefore more complicated than it appears at first glance.

The kind of gasoline in which the dyestuff is used is a factor in the stability of the color to light. For instance, many dyes which are satisfactory in a straightrun gasoline fade rapidly when used in gasoline produced by the cracking processes.

The color strength of the gasoline dyes is amazing. In commercial practice it is common to use from 2 to 15 parts of dye per million parts of gasoline. This corresponds to from 5 to about 40 grams of dye per thousand gallons of gasoline or from 2 to 15 pounds of dye in a 5,000-bbl. storage tank. In spite of the small amount used it is necessary that the solubility of the dyes be fairly high in order to resist any change in color by storage conditions, such as contact with water or exposure to freezing temperatures.

One of the earliest types of colors used in gasoline was the fatty acid salts of the basic (or triphenylmethane) dyes. A typical example of this is the oleate of malachite green, represented by the formula:

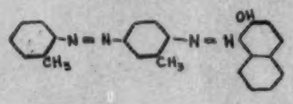


Such colors are now practically never used. Although they give exceedingly bright and brilliant shades, even in straightrun gasoline they are very fugitive. The increasing use of highly cracked gasoline, in which they fade more rapidly, has condemned them to the ranks of the unemployed.

The dyes which are principally in use at present fall into two chemical classifications; that is, the azo dyes and anthraquinone derivatives. These may also be classified by color since most of the red and yellow dyes are of the first class and most of the blues and violets belong to the second. The azo dyes are relatively much easier to make and therefore less expensive than the anthraquinone colors.

Azo dyes are characterized by the group —N=N—, to which they owe their color properties. The particular shade of the dye is controlled by the other groups present and by the number of azo groups in the molecule. The dyes are prepared by treating an aromatic amine with nitrous acid and coupling this so-called diazotized base with a phenol or with an aromatic amine. For example, DuPont oil yellow is obtained by coupling diazotized ortho-toluidine with ortho-toluidine and DuPont oil orange is obtained from diazotized aniline and beta-naphthol. Naturally, there are many such combinations possible, each differing slightly from the others in shade, strength, fastness and solubility.

The oil reds are usually a little more complex than the simple yellow dyes, frequently containing two or more azo groups. An example of this is DuPont oil red, the formula of which is:

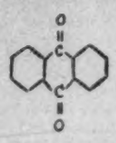


It is made by coupling diazotized ortho-aminoazotoluene with beta-naphthol. In absolutely pure form this dyestuff is known as Biebrich scarlet and is used medicinally for promoting the growth of skin on wounds.

In some cases oil oranges instead of being chemical individuals, that is, "self colors," are mixtures of an oil red and an oil yellow. The use of such products offers one advantage and one disadvantage. The advantage lies in the fact that the shade can be varied to suit the customer by varying the proportions of the two component dyestuffs. The advantage to the consumer, in this case the oil company, is that by varying the proportions of the two dyestuffs gasoline of varying initial color can be given a uniform appearance. The disadvantage of this procedure is that unless great care is used in selecting two dyestuffs of equal light fastness and equal sensitiveness to gasoline, the colored gasoline may change in shade during storage due to the preferential fading of one of the constituent dyes.

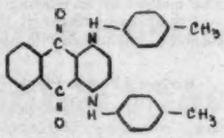
Although a considerable number of oil soluble blue, green and violet azo dyes are known, none of them possesses satisfactory light fastness in cracked gasolines. A few of them can be used in straightrun gasoline but this demand is very limited.

To secure the requisite fastness in these dark shades it is necessary to use derivatives of antharquinone, the structural formula of which is:



This group is responsible for the color of these compounds and, as in the case of the azo dyes, the shade can be modified by changing the other groups in the molecule. The anthraquinone derivatives are considerably more expensive to make than the azo dyes, and for this reason the red and yellow anthraquinone derivatives are never used in gasoline since the azo dyes are adequately suitable.

One of the patents in this field, U. S. Reissue No. 16,937, mentions the use of amino and diamino athraquinones. This is a reissue of U. S. Patent No. 1,654,259, which was drawn to cover the compound, Boycite. The most widely used gasoline blue, which is available under a variety of names, is the compound, 1:4-ditoluido-anthraquinone:



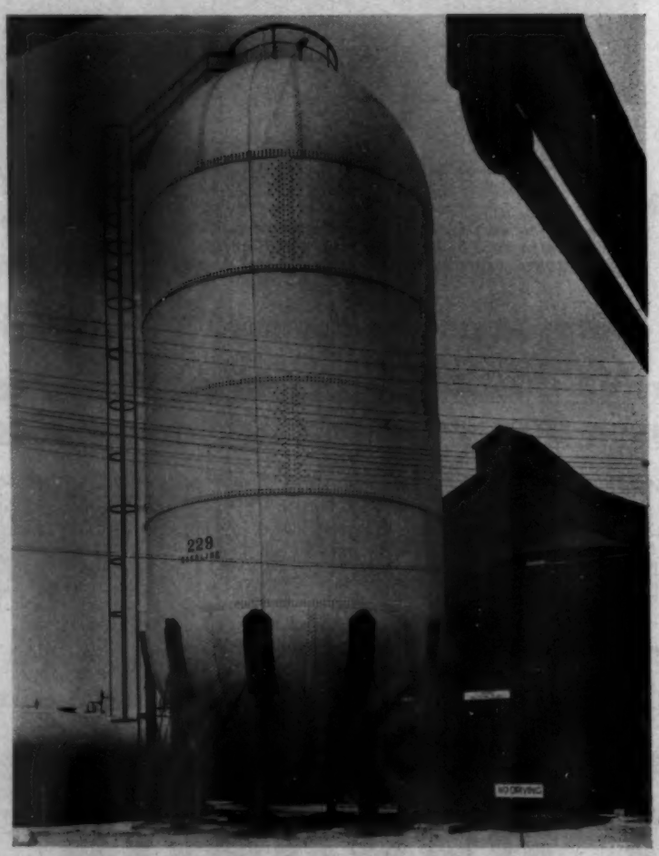
Violet shades are produced either with pure anthraquinone compounds or by the use of one of the ordinary anthraquinone blues shades with an azo red. The mixed colors in this case are usually less satisfactory than the pure dyes for the shades usually are less brilliant. Purple shades are nearly always obtained by shading a violet or reddish blue anthraquinone dye with an azo red. The shades in this case are more brilliant since a greenish blue cannot be used at all.

A number of peculiarities are noted in the green shades. First, no satisfactory greens are known which are pure compounds. The only method of obtaining greens of adequate fastness is by mixing a greenish anthraquinone blue with an azo yellow. Many times it has been found that although the blue alone is faster than the yellow the mixture will fade to an extremely yellowish green, i.e., the blue fades more rapidly than the yellow. This phenomenon is connected with the compostiion of the gasoline since the same mixture will exhibit this property in some gasolines and not in others. It is not connected with the unsaturation of the gasoline since it can be observed both in cracked and straightrun gasoline although in some cracked gasolines it does not occur. So far this peculiarity is unexplainable.

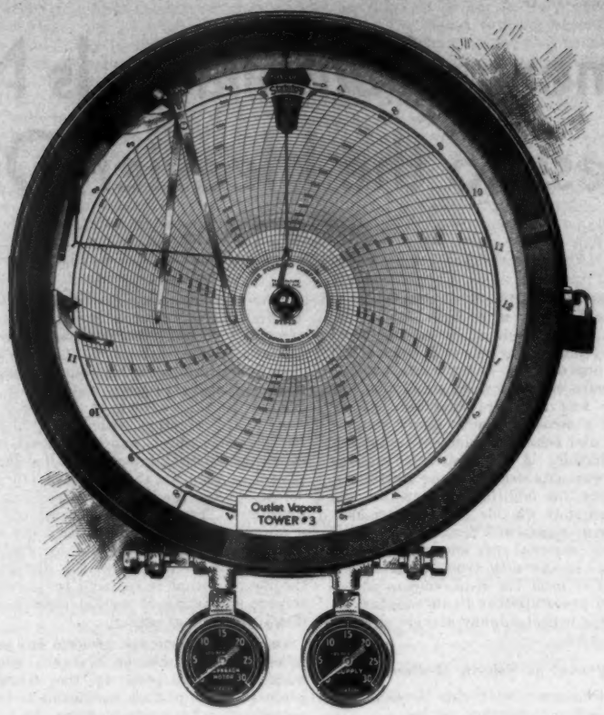
An objection to the use of greens of this type is that nearly all of the oil yellows on the market have a pronounced reddish cast which makes the resulting greens dull and more of an olive shade than an emerald. The latter is considerably more appealing and should be very desirable.

The present state of the art of coloring gasoline therefore offers opportunities for important developments. Many improvements are still needed and many gaps remain to be filled. The dyestuff industry is fully awake to the necessities involved and is earnestly working to provide a full range of faster dyes.

Butane Storage Tank at Eastern Refinery



High pressure tank for storage of butane at Baltimore, Md. refinery of Continental Oil Co. Tank of the vertical blimp type stores light product at 50 pounds pressure and has a capacity of 5,000 barrels. Tank designed and installed by Chicago Bridge & Iron Works



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Solvent Treatment of Distillates Is Now Applied With Success to the Heavier Oil Fractions

By ALFRED W. NASH
Professor of Petroleum Technology, University of Birmingham, England

The chemical treatment of oil distillates, particularly of the heavier fractions, leaves much to be desired since comparatively large quantities of chemicals have to be expended and the refining objective is frequently only attained after large oil losses have been incurred. It is obvious that if the destructive action of chemical reagents could be replaced by the physical action of a solvent which would dissolve the undesirable portion of the distillate and in which the desired end product was insoluble this would enable a saving in treating costs to be obtained.

While a considerable number of proposals for the accomplishment of these ends are to be found in the literature no real progress in this direction was made until the advent of the Edeleanu process in 1909.[1] This was the first successful commercial treating process to employ solvent action. Initially, the process was limited to the treatment of light oils such as gasoline and kerosene, but its scope has gradually enlarged and it is now successfully applied to the large scale treatment of heavier fractions.

The general principles of the Edeleanu refining process are well known. The extraction medium, liquid sulphur dioxide, removes at low temperatures aromatics and unsaturated hydrocarbons from the less soluble paraffinic and naphthenic constituents, thereby effecting the necessary refining action. The hydrocarbon material removed in the extract is recovered by distilling off the sulphur dioxide which is recirculated.

Following the success of this process the extraction method of refining petroleum oils attracted considerable attention, and proposals for the utilisation of a large variety of substances as solvents appeared. These included the use of such compounds as alcohols,[2] esters,[3] ketones,[4] phenol,[5] dimethyl sulphate,[6] laevulinic acid,[7] carbon dioxide,[8] and sulphur dioxide in acetone.[9]

Designed for Some Special Purpose

Most of these were applied to light fractions for the accomplishment of some special purpose such as gum removal. In addition the use of aniline[10] and nitrobenzene[11] was proposed for the refining of lubricating oil fractions. In 1931 Ferris, Birkhimer and Henderson[12] published the result of their studies on 110 substances as possible selective solvents for the extraction of lubricating oils and evolved a satisfactory basis for the comparison of solvent selectivity. This work resulted in the selection of nitrobenzene as the most suitable solvent for the treatment of lubricating oil distillates. An extraction process employing this solvent has now been tried out on a commercial scale[13] by the Atlantic Refining Co., and has proved capable of handling a wide range of lubricating stocks.

It has been found possible to produce lubricating oil economically from cheap crudes which is equal and even superior in quality to the best Pennsylvanian oil. While the process gives flexibility of crude source, oils for special purposes may readily be prepared without plant modifications. The total processing cost is reported to be $0.37 per barrel of oil charged and if the extract is credited at charge stock value the cost becomes $0.71 per barrel of treated lubricant produced.

The utilization of the Edeleanu process for treatment of lubricating oil distillates has been investigated by the Edeleanu Co., Ltd., and found to be suitable for use with light lubricating stocks. When employed on certain types of heavy lubricating oils it did not result in the improvement necessary to produce a raffinate of the desired standard. The process was therefore modified by employing a mixed solvent,[14] liquid sulphur dioxide and benzol, in place of liquid sulphur dioxide. A more drastic refining action was obtained with the double solvent since the addition of benzol to the liquid sulphur dioxide greatly increased the solvent power and resulted in a more complete removal of undesirable components. In the new type of plant constructed to meet the requirements of the modified process either liquid sulphur dioxide or a benzol-sulphur dioxide mixture can be used.

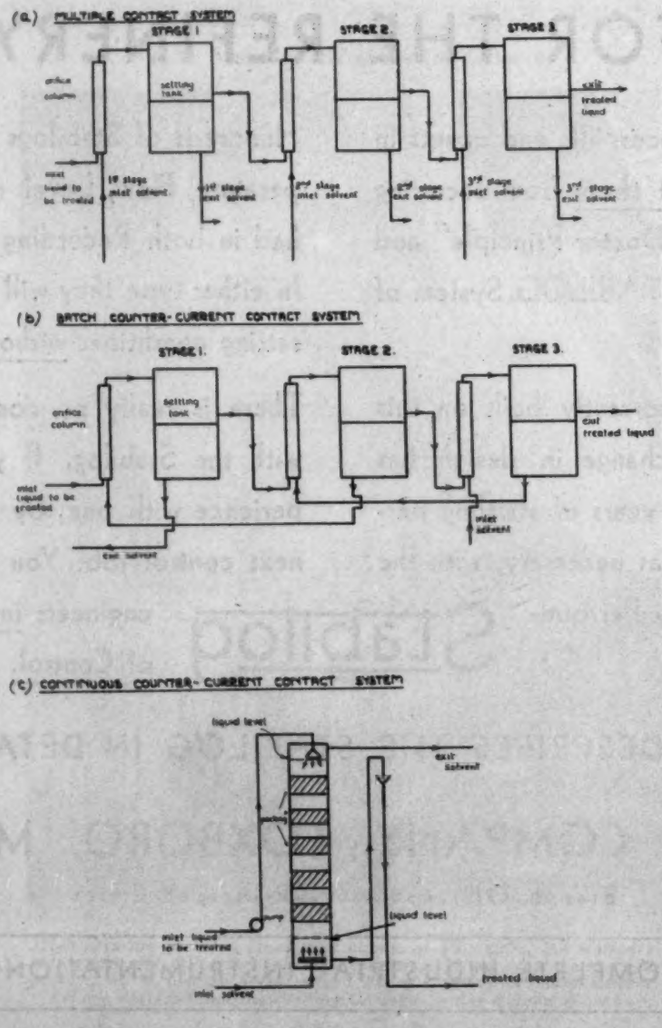
Phenol as Solvent Medium

Simultaneously with this development of the solvent treating process in the United States, the Burmah Oil Co. was proving a process for light distillates employing phenol as the solvent medium.[5, 15] In this method phenol or cresol with 5 to 15 per cent of water is employed as the treating material. The refining is carried out at a temperature of 60° C. The raffinate obtained is freed from solvent by means of a caustic soda wash, while the phenol in the extract is recovered by fractional extraction with both cold and hot phenolic water, and the phenol concentrated by distillation. Undiluted liquid phenol is used by the Standard Oil Development Co. for refining lubricating oil distillates. Treatment is carried out at a temperature below 60° C. and the raffinate is freed from phenol by distillation. For lighter mineral oil distillates the liquid phenol is replaced by a double solvent consisting of methyl alcohol and 65-95 per cent of phenol

On the Continent the problem has been investigated by Doctor Karpati, whose work has given rise to the Karpati process.[16] This process, applicable to both petroleum and tar oils, employs the principle of fractional precipitation. The oil to be treated is dissolved under pressure in the solvent, usually aqueous alcohol, at a high temperature. During this treatment all materials with the exception of pitch are dissolved. By means of either progressive cooling of the mixture or variation in the concentration of the solvent, the dissolved material separates in fractions of increasing solubility. The fractions obtained are claimed to possess a high degree of purity and to require little further refining. As far as the present author is aware, however, this process has not yet progressed further than the semitechnical plant scale.

Enough has been said in the preceding paragraphs to show how the development of this useful refining principle has progressed and how increasingly important an operation it is becoming in the petroleum industry. In view of these facts it is evident that an examination of the principles involved may prove of considerable interest and importance.

FIGURE 1



Contact Methods

Methods for carrying out an extraction process may be classified simply under three main headings, namely:

1. Single contact extraction.
2. Multiple contact extraction.
3. Countercurrent contact extraction.

In the single contact extraction process the liquid to be treated and the extraction medium are contacted in a single stage, and after the mixing operation is complete, the two phases are separated either by centrifuge or by settling and decantation. The process may be carried out by either batch or continuous methods, employing such mixing devices as agitators fitted with revolving paddles or orifice columns. In the latter case where the two liquids flow continuously and co-currently through a mixing device the effect produced is essentially equivalent to a single contact.

Multiple contact extraction involves contact of the two phases in a single stage exactly as in the previous method, followed by contact of the treated liquid, after separation, with fresh solvent, this operation being repeated as often as desired. Both batch and continuous methods may be employed to carry out the operation. A continuous method making use of orifice columns and settling tanks is illustrated in Figure 1 (a).

In the countercurrent contact method the two liquids are contacted by flowing countercurrently through some suitable type of equipment. Such equipment can conveniently consist of a packed vertical tower, the incoming liquid entering at the bottom and leaving at the top after separating from the second liquid which flows down the unit in the opposite direction, as in Figure 1 (c). An alternative type of equipment takes the form of a number of pumps, orifice columns, or paddle agitated vessels and separators provided with cross connections to produce countercurrent flow, similar to that in Figure 1 (b).

The Distribution Law

Let us consider the simplest possible case where a substance dissolved in a liquid is removed by washing the solution with another liquid in which the solute possesses greatly increased solubility, and where the two solvent liquids are completely immiscible. If the resulting two-phase system is at equilibrium then the relationship between the concentrations of the common solute in the two solvents follows the distribution law. This law states that the ratio of the solute concentrations will remain constant at constant temperature. If C_1 is

the concentration of solute in the first and C_2 that in the second liquid then

$$\frac{C_1}{C_2} = K \qquad (1)$$

where K is a constant dependent only upon temperature. If the solute consists of different substances the rule holds for each single material. If the two solvents have their mutual solubility altered by the presence of the distributed solute then the law is not valid.

In the case under consideration the mutual solubility of the two solvent

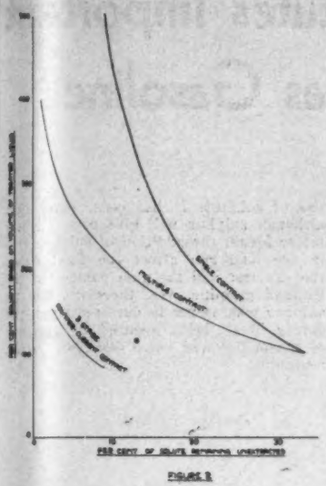


FIGURE 2

liquids in which the undesirable hydrocarbon constituents are distributed varies widely with changes in temperature and concentration of distributed hydrocarbons. The distribution law is not valid in such a case. The actual equilibrium between the two immiscible phases would be exactly characterized only by the use of some complex multiple component diagram. However, although the distribution law cannot be rigidly applied, it can be used to derive general indications as to how such systems will behave in certain circumstances.

Methods of Computation

If y_o = weight of solute in liquid before extraction.

y_n = weight of solute in liquid after nth extraction.

P = volume of solute free liquid.

W = volume of solute free treating solvent.

K = distribution coefficient.

Then for the single contact extraction process (n = 1) we may write in accordance with the distribution law:

$$\frac{\frac{y_1}{P}}{\frac{y_o - y_1}{W}} = K$$

$$y_1 = y_o\left(\frac{KP}{KP + W}\right) \qquad (2)$$

In an exactly similar way it can be shown for a multiple contact extraction process that[17]

$$y_n = y_o\left(\frac{KP}{KP + W}\right)^n \qquad (3)$$

where n = the number of ideal stages or single contacts employed.

Taking the last case of the countercurrent process and retaining the previous symbols except that weights and volumes now become weight and volume rates it can be proved[18] by the aid of the distribution law and a material balance over the system that

$$y_n = \frac{x_o C(C^n - 1) + y_o C^n (C - 1)}{C - 1 + C(C^n - 1)} \qquad (4)$$

Here $C = \frac{KP}{W}$ and the additional symbol x_o which has been introduced represents the weight per unit time of solute entering the system in the inlet treating solvent. The introduction of this term is essential if the solvent is being recovered and circulated. In this case "n" again represents the number of ideal stages employed. If the apparatus is of the tower type then "n" becomes the number of ideal stages to which the apparatus is equivalent. It should be understood that the stages referred to in all the above formulae are ideal, in so far as equilibrium between the two fluids is assumed to be reached in each stage. That is, the liquids leaving each stage are in equilibrium.

Three Methods Compared

A comparison of the three methods of extraction by means of these formulae is shown in Figure 2. The curves show the percentage of solute extracted by various amounts of solvent, for a case where the distribution coefficient is 0.5. The multiple contact curve represents the extraction obtained by washing with the same volume of solvent (equal to the total volume of treated liquid) in each stage, and shows the effect obtained when the total volume of solvent used is increased by increasing the number of stages. The small curve represents the effect obtained by using different amounts of solvent in a three-stage countercurrent process. In Figure 3 the results given in practice by exactly similar processes are illustrated. The curves represent the nitro-benzene extraction of a lubricating oil, and are taken from a recent paper by Ferris and Houghton.[12] The viscosity-gravity constant of the raffinate is plotted against the amount of solvent used, and since this property is approximately additive it must be directly proportional to the amount of solute hydrocarbon material not extracted. Figures 2 and 3 are therefore comparable, and show that the use of these formulae employing the simple distribution law make possible an accurate forecast of the best method of extraction procedure to be obtained. It

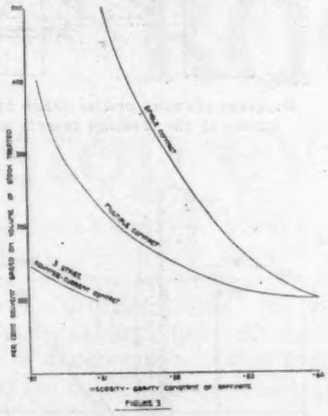


FIGURE 3

will be noted from these figures that, with the same amount of solvent, both multiple and countercurrent treatment give a raffinate containing smaller amounts of unextracted solute than the single contact process, which means a better yield of superior quality raffinate for an expenditure of the same amount of solvent.

The single contact method of extraction procedure need not be discussed in detail as it obviously does not offer any theoretical advantages, nor can any practical benefits be claimed on its behalf.

Multiple Contact Extraction

The multiple contact principle, while not so efficient as countercurrent operation, is very definitely superior to single contact working, and can on occasion be applied in practice with advantage if facilities for countercurrent running are not available. In such circumstances, the question of how to employ it to the best advantage immediately arises. If a liquid is to be treated with a given quantity of solvent, this can be applied in a variety of ways. The liquid can be treated in any number of stages employing equal or varying amounts of solvent at each stage.

It is obvious from an inspection of Equation 3 that complete extraction can never be attained but can be approached with any given volume of solvent by increasing "n." Better results will be obtained by dividing the extracting solvent into a large number of small portions. The number of stages which can be employed, however, must be definitely limited by considerations of time and expense. Supposing this number "n" to have been fixed by these primary limitations the only question remaining to

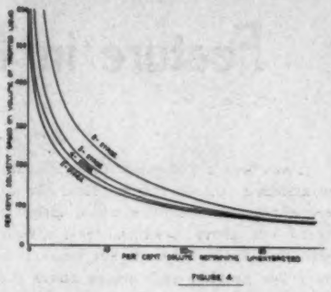


FIGURE 4

be answered is: Into what size portions must the solvent be divided in order to obtain the maximum extraction?[19]

If w_1 = vol. of solute free solvent used in first extraction,

w_2 = vol. of solute free solvent used in second extraction,

w_n = vol. of solute free solvent used in nth extraction,

then Equation 3 may be rewritten:

$$y_n = y_o\left(\frac{KP}{KP + w_1}\right)\left(\frac{KP}{KP + w_2}\right) \cdots \left(\frac{KP}{KP + w_n}\right) \qquad (5)$$

Taking the simplest case where n = 2 and inverting:

$$\frac{y_o}{y_2} = \frac{(KP + w_1)(KP + w_2)}{(KP)^2}$$

but $w_2 = W - w_1$,

$$\therefore \frac{y_o}{y_2} = \frac{(KP + w_1)(KP + W - w_1)}{(KP)^2} \qquad (6)$$

The conditions necessary to ensure that $\frac{y_o}{y_2}$ is a maximum are obtained when

$$\frac{d\left(\frac{y_o}{y_2}\right)}{dw_1} = 0 \text{ if } \frac{d^2\left(\frac{y_o}{y_2}\right)}{dw_1^2} \text{ is negative.}$$

On differentiation we get:

$$\frac{d\left(\frac{y_o}{y_2}\right)}{dw_1} = \frac{W - 2w_1}{(KP)^2} = 0$$

$$\text{and } \frac{d^2\left(\frac{y_o}{y_2}\right)}{dw_1^2} = -\frac{2}{(KP)^2}$$

Therefore $\frac{y_o}{y_2}$ is a maximum

$$w_1 = \frac{W}{2} = w_2.$$

Maximum Degree of Extraction

Therefore the greatest amount of extraction is obtained in two stages when the volume of solvent available is used in two equal parts. In general, the maximum process of extraction is produced by the multiple contact process when the solvent is employed "n" times in equal parts, that is if

$$W = w_1 + w_2 + w_3 \ldots + w_n$$

maximum extraction is attained when

$$w_1 = w_2 = w_3 \ldots = w_n$$

In Figure 4 the effect of increasing the volume of solvent and the number of stages is shown. With larger volumes of solvent the advantage gained by increasing the number of stages is not so pronounced. With small volumes of solvent, however, very great improvements can be obtained by increasing the number of extractions.

Countercurrent Contact Extraction

The advantages of countercurrent over multiple contact extraction procedure is brought out in Figure 5. In the countercurrent process complete removal of solute is approached with an infinite number of stages. In the case illustrated in this figure (K = 0.5, W = 3P) this point is closely approximated by a five-stage process, while the multiple contact method even with an eight-stage process has not approached the complete removal point.

In Figure 6 the effect of varying both solvent volume and the number of stages is illustrated graphically. With an increasing volume of solvent the advantage to be gained by increasing the number of stages becomes smaller. The point of complete removal is approached with a decreasing number of stages when the volume of treating solvent is increased.

When countercurrent extraction is carried out by mixing liquid and solvent together in stages as in the batch countercurrent method illustrated in Figure 1 (b), an actual stage would be equivalent to the ideal stage, to which the formulae apply, if equilibrium were attained at each actual stage. In order to obtain this condition in practice perfect contact between the two phases is essential. This state of affairs requires exceedingly intimate mixing with a long time of contact, and for reasons of econ-

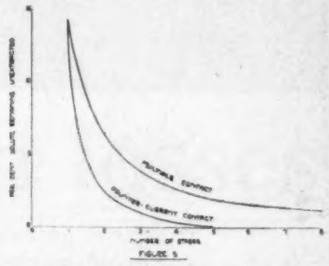


FIGURE 5

omy the attainment of such an end is never attempted. The proximity to which the solute concentrations reached in an actual stage approach this equilibrium point can be considered a measure of the stage efficiency. The efficiency of a stage may then be defined by the following equation:[20]

$$\frac{\frac{x_o}{W} - \frac{x_{n+1}}{W}}{\frac{x'_o}{W} - \frac{x_{n+1}}{W}} \qquad (7)$$

where $\frac{x_o}{W}$ = the concentration of solute in the treating solvent leaving the nth stage.

$\frac{x_{n+1}}{W}$ = the concentration of solute in the treating solvent entering the nth stage.

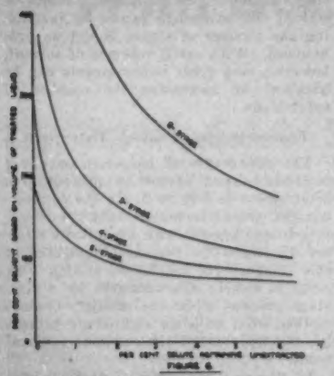
$\frac{x'_n}{W}$ = the concentration of solute in the treating solvent leaving the nth stage if the solvent were in equilibrium with the treated liquid leaving this stage.

Efficiency Depends on Method Employed

The efficiency of any extraction stage will, of course, largely depend on the

method employed for obtaining contact, and will be a function of the interfacial surface area, the rate of stirring or turbulence of the two phases, the time of contact, and the rates of diffusion of the solute through the two liquids.

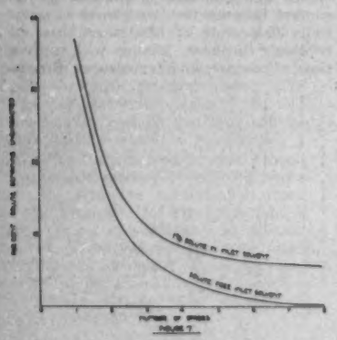
If the apparatus is of the tower type, "n" represents the number of ideal stages to which the performance of the ap-



paratus is equivalent. In the case of a packed tower, the packed height equivalent to an ideal stage can be used to characterize the efficiency of the apparatus under any given operating conditions. This characteristic will vary with the time of contact and the rate of extraction and may be expressed as a

function of the ratio $\frac{W}{P}$.

In the previous instances where countercurrent operation has been discussed, the inlet solvent has been taken to be free from solute. When the inlet solvent



contains some solute, that is where the solvent regeneration section has failed to remove the last traces of solute from the solvent, it will be seen from Figure 7 that complete removal of solute from the

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treated liquid becomes impossible, and that the amount of solute remaining in the treated liquid approaches a definite concentration. It is found that this concentration is such that the inlet solvent and exit treated liquid approach equilibrium. The amount of solute in the inlet solvent, therefore, definitely determines the degree of extraction which can be attained, and the efficiency of the process as a whole depends on the efficiency of the solvent regeneration section of the unit.

In the past, considerable attention has been devoted to the development of equipment for the contacting of a gas and a liquid, and the application of established fundamental concepts has resulted in many improvements in both processes and equipment. Although the principles underlying such problems have been adequately established for some time, little attempt has been made to apply them to the important case of contact between two liquids. Since the design of this type of equipment is still largely empirical, the necessity for the prosecution of fundamental research in this field is imperative if the general efficiency of liquid-liquid processes is to be brought to the present high standard prevailing in gas absorption, distillation and heat exchange operations.

Control of Fixed Gases Constitutes Important Feature in Treating East Texas Gasoline

By A. C. STURGIS

Chief Chemist, East Texas Refining Co.

It has been a well established fact that straightrun gasoline from East Texas crude possesses qualities which make it stand out above gasolines from almost all other fields. The sulphur content is very low gravity, high octane above the average, and above all other qualities, especially from the cost accountant's viewpoint, is the fact that the material is naturally sweet to doctor and is noncorrosive with no treatment of any kind.

Cracked gasoline made from East Texas crude, on the other hand, while low in sulphur, requires treatment before being marketed. A system of treatment was devised in our plant consisting of a set of baffle coils, two towers of conventional design, with the first tower equipped with a 10-inch relief line 6 feet higher than the tower itself. This casing is braced to the side of the treating tower and is equipped with an orifice plate and 2-inch valve, in order to control the amount of fixed gases, which contain an appreciable quantity of hydrogen sulphide. We found that this control permits us to allow the material treated to give us the doctor break in the shortest possible time and allows for changes of material or changes of weather conditions.

Direct from Stills

In our treatment the gasoline direct from the stills enters the 10-inch casing and from thence flows to the tower itself, into which a doctor solution is pumped. The gasoline and doctor solution then are pumped to the contacting coils, together with approximately 50 per cent of semitreated. The treated material from the coils then enters the tower opposite to the connection on the recirculating pump and at this point the gasoline is sweet, but the material has not settled out.

A connection is also available whereby air can be admitted to either go through the entire length of the contacting coils or can be by-passed and used at the point of discharge just before the gasoline enters into the first tower. We have found that by controlling this air that we can control the time element and in turn affect the total gum present in our finished gasoline.

The scheme whereby 50 per cent of raw gasoline and 50 per cent of semitreated, together with the doctor solution, enter the contacting coils, has been found to give us a much better color than we could otherwise expect.

Better Colored Material Obtained

Experience has indicated to us that the time element, both with respect to the amount of doctor solution used and also in relation to the gasoline entering the coils direct from the stills without a preliminary tank being used, gives a much better colored finished material. In other words, the smallest possible amount of caustic or doctor solution, together with fast treatment before the gasoline is allowed to come in contact with the atmosphere, gives the best results.

The treated material is allowed to flow from No. 1 tower to No. 2 tower from near the top of the first tower to the bottom of the second, and the finished material goes to storage from near the top of the second tower. At this point the gasoline has settled out and can be loaded with but little settling time after leaving the last tower.

You will note that in all our discussions no mention has been made of the use of sulphur. It has been found that although sulphur will give us a slightly faster break, the addition of sulphur will in the long run affect the final color, the sun test and the gum content of the finished gasoline. We, therefore, use no sulphur whatsoever in our treatment, the doctor break being secured by the use of the orifice and valve described in the beginning.

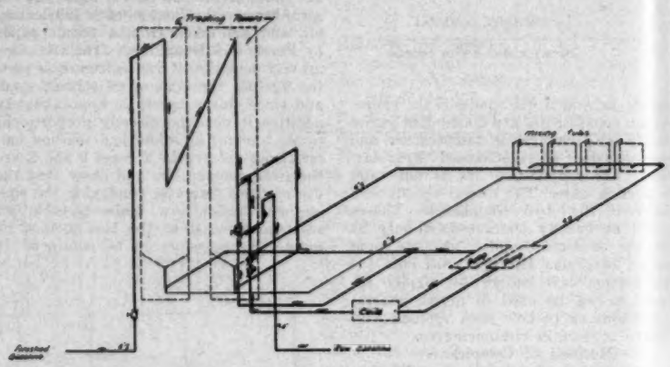
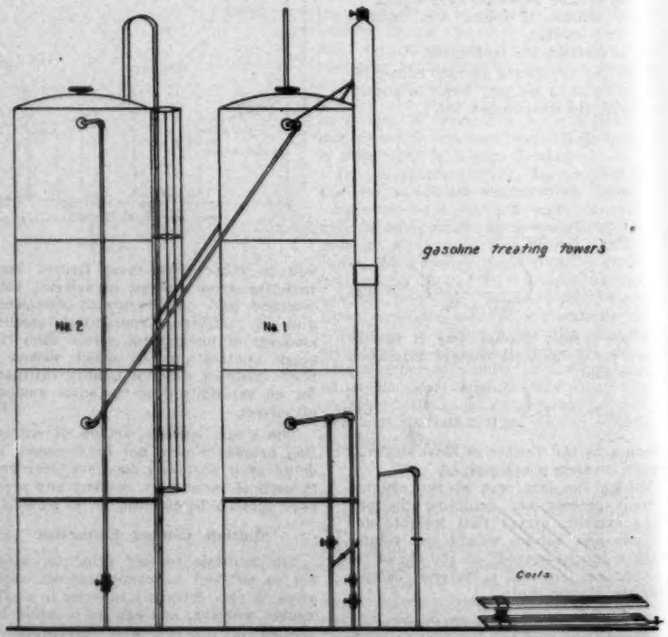
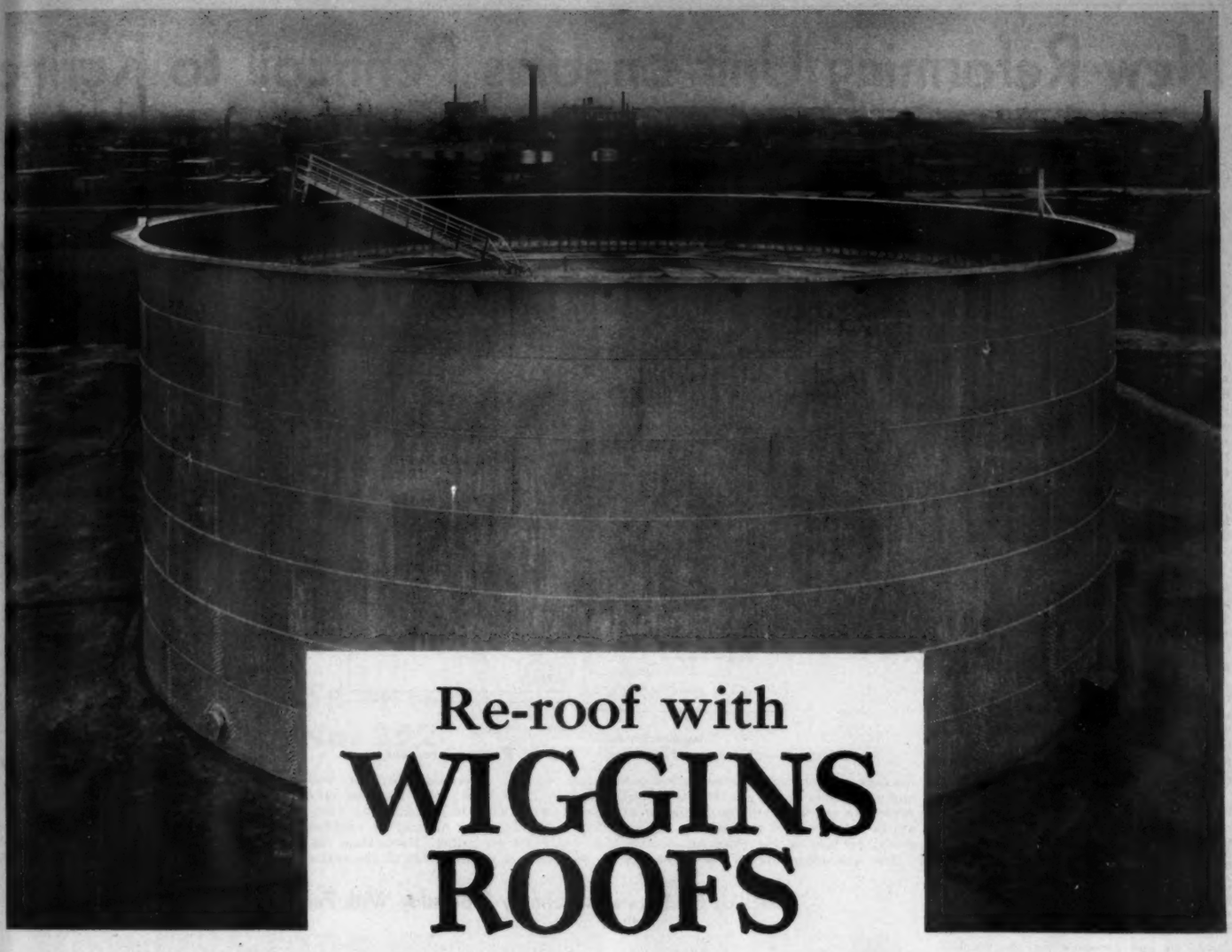


Diagram showing course taken by raw gasoline from the point of entrance to the treating towers until it emerges as finished gasoline



Treating installation at Longview refinery of East Texas Refining Co. The 10-inch relief line braced to the side of tower No. 1 is 6 feet higher than the tower itself. It is provided with an orifice plate and a 2-inch valve to control the volume of fixed gases



Re-roof with WIGGINS ROOFS

»»»they stop evaporation losses

Whenever you have a tank that needs re-roofing, you have an opportunity to make a big saving. The additional cost of a Wiggins Roof over an ordinary cone roof is quickly offset by the saving shown through the elimination of evaporation. After that the saving is net gain.

By stopping the escape of oil vapor, Wiggins Roofs maintain the original gravity and anti-knock rating. They stop the loss of the lighter fractions which are always first to evaporate. This is particularly important on marketing tanks where weathered out products cause dissatisfaction and lose customers.

An added advantage which may be of great importance is the safeguard against fire provided by Wiggins Floating Roofs. They have recently been approved by the Underwriters' Laboratories. Under certain conditions, the reduction in corrosion from sour oil is also a primary consideration.

Wiggins Floating Roofs should be used on every working tank to secure maximum savings. For standing storage tanks, the Wiggins Breather Roof offers adequate and very economical protection. It eliminates the daily breathing loss.

It will pay you to re-roof now, particularly if you replace old air-leaky roofs with Wiggins Roofs. Our nearest office will gladly furnish information and estimates without obligating you in any way.

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Fabricating plants in BIRMINGHAM, CHICAGO, and GREENVILLE, PA.

New Reforming Unit Enables Pennzoil to Refine Gasoline of Uniformly High Octane Rating

By P. M. ROBINSON
The Pennzoil Co.

Gasoline reforming is one of the recent developments in petroleum refining and one which offers great possibilities to refiners who are forced to dispose of large quantities of straightrun gasoline.

Straightrun gasoline made from Pennsylvania crude is entirely unsuitable as motor fuel for modern cars. Of course, it is still possible to dispose of some straightrun gasoline as third grade for use in older model cars, but each year a large number of these cars are retired and in the near future no car will be in operation that will be able to use this gasoline.

Refiners today are faced with the necessity of making all their gasoline of high octane rating and of being prepared to raise this rating as compression ratios of automobiles are increased.

The automotive industry is making some progress by the use of different materials of construction and different designs of combustion chambers in the manufacture of cars that will use gasoline of lower octane rating than is demanded today, but these developments are progressing so slowly that the refiner need not hesitate to install proper equipment for making a suitable fuel for present-day cars. This equipment will have depreciated long before cars manufactured today, which require antiknock gasolines, are retired from the road.

Pennsylvania crude may be divided into the following products:

	Per cent
Gasoline	35.0
Kerosene	16.0
Gas oil	12.0
Neutrals	14.0
Wax	1.6
Petrolatum	2.9
Bright stock	16.0
Loss	2.5

Gas oil and kerosene may be cracked by suitable processes yielding 70 per cent of finished gasoline of 74 octane number. The 28 per cent of combined gas oil and kerosene shown will therefore yield 19.6 per cent of high octane number gasoline.

Used With Remarkable Success

A blend of 80 per cent, 74 octane number gasoline plus 20 per cent of 50 octane number straightrun gasoline, will give a 70 octane number gasoline. This 70 octane number blend has been used with remarkable success in mountainous districts like those found in Pennsylvania. Therefore, only 24.5 per cent of the crude can be converted into marketable gasoline, leaving the refiner with 30.1 per cent of his crude as straightrun gasoline of 50 octane number to dispose of in the best possible manner.

A yield of 80 per cent of 74 octane number finished gasoline may be made by reforming straightrun gasoline. Reforming of 25 per cent of the crude as straightrun gasoline will yield 20 per cent of the crude as 74 octane number gasoline which, when blended in an 80-20 ratio with the remaining 5 per cent of straightrun gasoline will yield 25 per cent of 70 octane number gasoline. This makes a total of 49.5 per cent of the crude as finished motor gasoline suitable for use by the general motoring trade.

Pennsylvania crude will then divide into the following products:

	Per cent
70 octane number gasoline	49.5
Gas	8.8
Residue fuel oil	4.7
Neutrals	14.0
Wax	1.6
Petrolatum	2.9
Bright stock	16.0
Loss	2.5

Petrolatum may also be cracked, if so desired, and the figures will change accordingly. The total of 13.5 per cent of gas and residual fuel shown will be found to balance rather well the fuel requirements of a complete refinery processing Pennsylvania crude. These two fuels are adapted to burning in combination gas and oil burners or the gas may be burned while the cracking and reforming units are in operation and the residual fuel oil stored for use during clean-out periods.

The gas made during the reforming operation may be credited with its equivalent in coal at the current price. Based on B.t.u. content, coal at $2.50 per ton is equivalent to gas of 1,000 B.t.u. cubic feet, at 12½ cents per thousand. Gas made by the reforming operation will contain 1,500 B.t.u. cubic feet and may be credited with 18.75 cents per thousand. Residual fuel oil may be credited at 1½ cents per gallon. Using these figures, the fuel requirements of the entire refinery may be taken care of efficiently and economically.

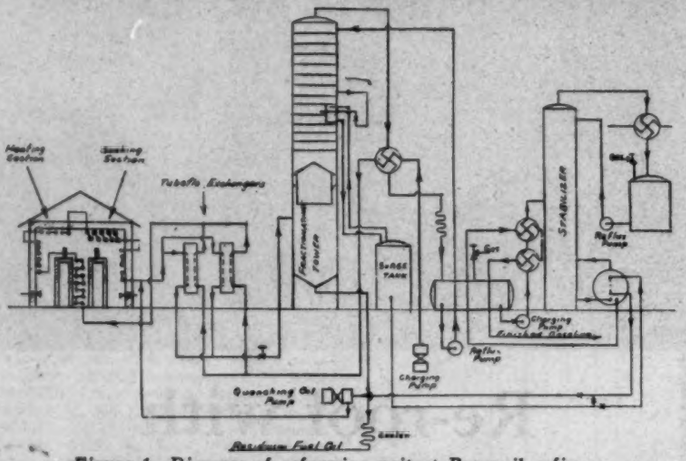


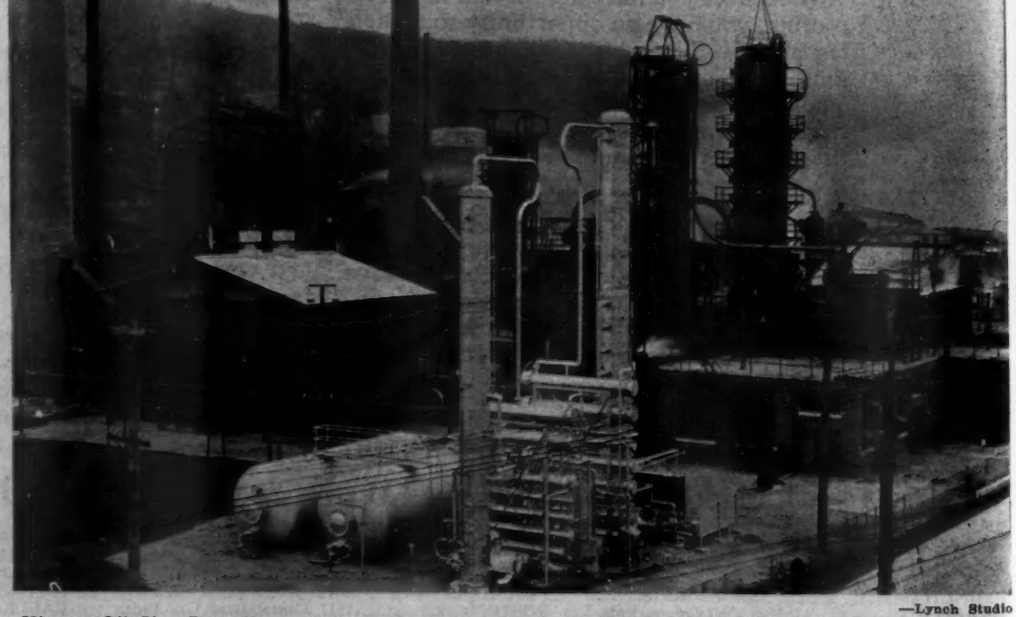
Figure 1—Diagram of reforming unit at Pennzoil refinery

With these facts in mind, the Pennzoil Co. has recently put into operation a plant capable of reforming 3,000 bbls. per day of straightrun gasoline into high octane motor fuel. This unit was designed and constructed by the Arthur G. McKee Co. and licensed under patents of the Dubbs process. The plant incorporates in its design and construction some novel features, which should be of interest to those refiners who are building up large stocks of straightrun gasoline and who wish to market a motor fuel suitable for modern cars.

General flow through the plant is shown in Figure 1. Operating conditions are as follows: Gasoline is pumped to the unit by the charge pump under a pressure of 800 pounds per square inch. A preheat is given the charge by passing it through a high-pressure exchanger countercurrent to the cracked vapors leaving the fractionating column. The charge then passes through two Griscom-Russell "Tube-Flo" exchangers in parallel countercurrent to the cracked vapors and quenching oil entering the tower. The charge receives a preheat of 300° F. through these two exchangers.

Charge then enters the convection bank of tubes in the furnace nad is heated to 650°, the to front wall heating bank, then to roof heating bank. The temperature of charge in the last tube in the heating bank is 990° F., and this temperature is maintained constant through

Cracking Facilities at a Refinery Operating With Pennsylvania Crude Oil



—Lynch Studio

View at Oil City, Pa. refinery of the Pennzoil Co., showing facilities to carry on high temperature distillation of all charging stocks in the production of cracked gasolines including the reforming of naphtha fractions. In center foreground is a gasoline recovery unit which operates in conjunction with cracking stills

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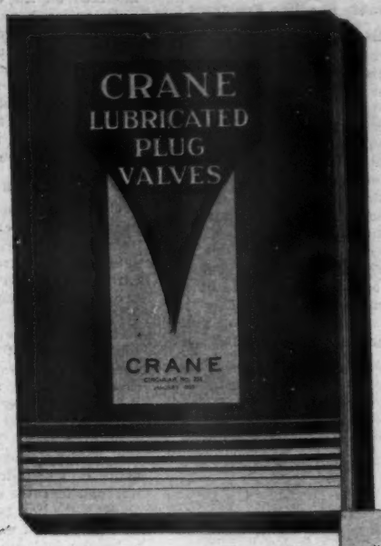

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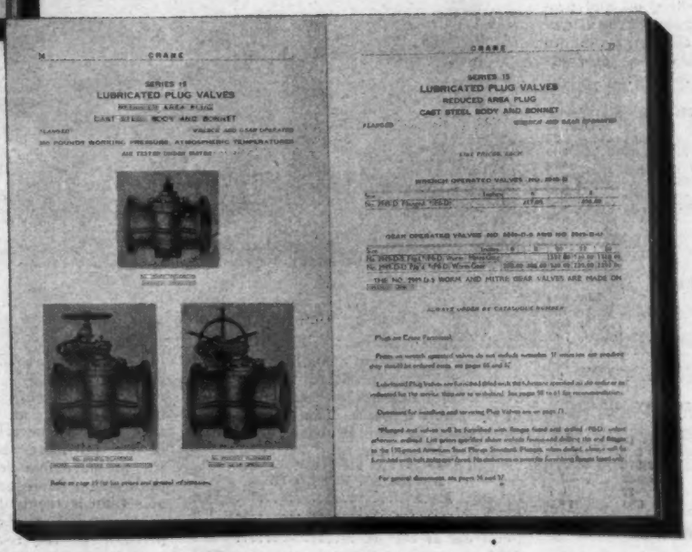

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the soaking bank. The soaking bank is a separately fired section from the heating bank and hot gases from these two sections pass through the convection bank. Tubes in the soaking bank are protected from direct radiation of the fires in the heating section by brick checker work baffles. Cracked vapors are quenched in the transfer line immediately upon leaving the furnace. This process stops cracking at once and furnishes liquid to wash the transfer line and the tubes in the heat exchanger so that no coke is formed and polymerized residuum is swept along with the liquid into the flash chamber.

Pressure of 600 Pounds Maintained

A pressure of 600 pounds per square inch is maintained on the outlet of the heat exchanger by means of a DeFlores remote control valve operated from the control board. Residuum is dropped out of the cracked products in the flash chamber and the remainder passes through a baffle arrangement, to prevent entrainment, into the bottom of the fractionating tower. Pressure in this tower is maintained at 100 pounds per square inch. Endpoint distillate is taken from the top of the fractionator and passes through a heat exchanger and condenser into a large receiver tank. A pressure of 90 pounds per square inch is maintained in this receiver. Noncondensable gases are released from the receiver by means of an automatic back-pressure controller. A side cut is taken from the tower to furnish quenching oil and provision is made for by-passing the downcoming reflux around the surge tank to the trays below. A tabulation of operating conditions is as follows:

TEMPERATURES	Deg. F.
Charge	25
Oil entering furnace	300
Oil leaving convection section	650
Vapors leaving heating section	990
Vapors leaving furnace	990
Vapors entering exchangers	725
Vapors entering tower	650
Top of tower	370
Residuum	550
Quenching oil	450

PRESSURES	Lbs. per sq. in.
Charge pump	800
Tube still inlet	720
Tube still outlet	600
Tower	100
Gasoline receiver	90

Yields for an average day of operation are as follows:

	Bbls. per 24 hrs.	Per cent
Gasoline charged	3,978	...
Gasoline produced	3,393	80.4
Residual fuel oil	22	0.7
Gas and loss	563	18.9

Periodical Tests Made

Gases leaving both the receiver and the stabilizer are measured in cubic feet. Periodical tests of the specific gravity of these gases are made and percentages are then computed on a weight basis. While this method gives reasonably accurate results for process control, loss must be included in reports to correct for the discrepancy between weight and volume calculations. The yield of gasoline produced is based on finished stabilised product received in the run-down tanks. All figures shown with the exception of gas and loss are actual gauged volumes. Characteristics of the charge and products are as follows:

	Charge	Reformed gasoline
Gravity, A.P.I.	62.7	63.8
Distillation: I.B.P., ° F.	190	84
10 per cent, ° F.	160	130
20 per cent, ° F.	200	149
30 per cent, ° F.	239	177
40 per cent, ° F.	254	200
50 per cent, ° F.	272	224
60 per cent, ° F.	290	246
70 per cent, ° F.	316	269
80 per cent, ° F.	343	300
90 per cent, ° F.	364	344
E.P., ° F.	392	390
Oct. No.	50	74.0
Gum (copper dish), mg.	3	5
V.P. (Reid), lbs.	7	11.8
Accelerated oxygen bomb induction period, min.		280

The low gum content and high induction period of the oxygen bomb test are obtained by injection of 0.015 per cent of a gum inhibitor prepared by The Universal Oil Products for use by licensees of the Dubbs Process. This inhibitor has been used by the Pennzoil Co. for a period of 18 months.

RESIDUAL FUEL OIL	
Gravity, A.P.I.	6.2
Flash	140
Fire	180
Furol vis. at 122° F.	19.2
Pour	—10
Pct., per cent	8

Podbielniak low temperature distillations of various light products are as follows:

	Mol. % receiver gas	Mol. % stabilizer gas	Mol. % stabilizer gasoline
C_1	20.51	....	....
C_2	46.53	6.94	....
C_3	27.74	47.33	Nil
IC_4	....	29.68	....
C_4	5.20	6.25	12.27
IC_5	....	....	6.28
Residue	....	....	81.45

No Recoverable Gasoline Fractions

These distillations prove conclusively that there are no recoverable gasoline fractions in the gases from either the receiver or the stabilizer. Consequently no absorption plant is required with this unit. The stabilizer used in conjunction with this reforming unit was designed and constructed by members of the Pennzoil organization, and the Podbielniak distillations attest the efficiency of fractionation obtained. The heat required to operate the stabilizer is furnished by the quenching oil used in the reforming unit. This heat is extracted from the quenching oil on the suction side of the quenching pump, thus eliminating the necessity of making the quenching pump a hot oil pump and of making the heating coil in the stabilizer reboiler of high pressure tubes.

Vapor-locking in the pump does not take place with an arrangement of this kind because lowering the temperature of the oil more than compensates for the pressure loss from passing through the system. More quenching oil is available than is required to furnish the heat necessary for stabilization and the temperature of the reboiler is easily controlled by a by-pass around the heating coil.

The main point of interest in the reforming unit is the design and construction of the furnace. As previously stated, all cracking takes place in the furnace. The furnace is fired on both ends so that absolute control of temperature in either the heating or soaking section is obtained. This control is made possible by laying a separate gas line to each section through the control house with a globe valve in each line, having the wheel mounted on the control board.

Potentiometers mounted on the control board record temperatures in both sections and sensitive pressure gauges calibrated in tenths of pounds indicate the pressure on the burners. The operator is thus able to control the fires without leaving the control house. This type of control is inexpensive and has given perfect results with this unit.

Corrosion Not a Problem

Corrosion is not a problem in processing oils from Pennsylvania crude; however, in this unit, temperatures and pressures are too great to rely upon plain carbon steel. No data were available to prove conclusively that the addition of 0.5 per cent of molybdenum would increase the resistance to creep, at elevated temperatures, of furnace tubes, though short time tests had indicated this and there were data available on steel castings with 0.5 per cent molybdenum added, showing that allowable creep stress was increased. Therefore, all tubes in the heating and soaking sections were made of this alloy. The saving in cost was considerable over 4-6 chromium alloy or K A-2 alloy tubes. Ohio Lock return bends are used and there has never been a header leak on this furnace from the initial test to the present date. These headers are of cast steel and have 0.5 per cent molybdenum added.

The heat exchanger between the furnace and the tower is a Griscom-Russell "Tube-Flo" exchanger. The interesting feature is that no coke is formed in this exchanger as long as the unit is operated properly. While the unit was being designed an opinion was expressed that length of runs would be shortened because of coking in the exchanger.

There is nothing unique about the tower except that the flash chamber and fractionator are in one shell, making for economy of construction and erection.

The condenser equipment consists of one high-pressure exchanger manufactured by Ross Heater Co. and a box of submerged bent tube sections.

One of the greatest economies of this unit is that no steam is used during operation. Except for steam used in the tubes during blowdowns and that used for atomising oil in the burners while bringing the unit on stream, none is used at any time. There are only three pumps on the reformer proper, two of which are gas engine driven and one a motor driven

(Continued on Page 76)

—Lynch Studio

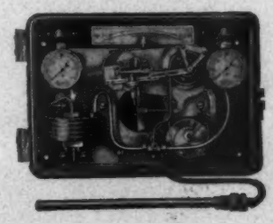
Close-up view of reforming unit at Pennzoil refinery

FIGURE 2—FUEL COSTS AND UNIT COSTS OF VARIOUS TYPES OF PUMPING UNITS COMPARED. MAINTENANCE, INTEREST AND DEPRECIATION AND OTHER EXPENSES NOT INCLUDED

Raw oil charging pump: Capacity (at 95 per cent volumetric efficiency) 102 gallons per minute; differential pressure 1,285 pounds

	Direct acting		Flywheel		Electric	Flywheel	Gas
Various types of pumping units:	Duplex simple noncondensing	Duplex compound noncondensing	Twin engine noncondensing	Cross compound noncondensing	Motor driven power pump	Cross compound condensing	Engine driven power pump
Size pumping unit	20x4½x18	16x24x4½x18	14x14x3x18	18x28x3x18	4x12	16 & 34x3x18	17x24 dc 4x12
Pump speed	66 f.p.m.	66 f.p.m.	49 r.p.m.	49 r.p.m.	41⅛ r.p.m.	49 r.p.m.	41⅛ r.p.m.
Steam pressure	100-lb. gauge	100-lb. gauge	100-lb. gauge	100-lb. gauge	.....	100-lb. gauge	.....
Exhaust pressure	Atmosphere	Atmosphere	Atmosphere	Atmosphere	.....	26-in. vacuum	.....
Efficiency, pump	.....	.....	.....	.....	85%	.....	85% net on the combined unit
Efficiency, motor	.....	.....	.....	.....	90%	.....	
Gas B.t.u. per cu. ft.	.....	.....	.....	.....	.....	.....	1,500 B.t.u.
Gas B.t.u. per h.p. hour	.....	.....	.....	.....	.....	.....	11,500 B.t.u.
Horsepower	76.5 hydraulic	76.5 hydraulic	76.5 hydraulic	76.5 hydraulic	100-h.p. motor	76.5 hydraulic	90-h.p. engine
Power per h.p. hour	84 lbs. steam	58 lbs. steam	43 lbs. steam	35 lbs. steam	.746 k.w.	20 lbs. steam	7.67 cubic feet
Power per hour	6,426 lbs. steam	4,437 lbs. steam	3,290 lbs. steam	2,678 lbs. steam	74.6 k.w.	1,530 lbs. steam	690 cubic feet
Boiler h.p. required	215 boiler h.p.	148 boiler h.p.	110 boiler h.p.	90 boiler h.p.	.....	51 boiler h.p.	.....
Cost of power	27c per 1,000 lbs.	27c per 1,000 lbs.	27c per 1,000 lbs.	27c per 1,000 lbs.	¾c per k.w.	27c per 1,000 lbs.	15c per 1,000 cu. ft.
Cost per hour	$1.735	$1.198	$0.889	$0.723	$0.652	$0.414	$0.104
Cost per 24 hours	41.64	28.74	21.34	17.35	15.67	9.94	2.50
Cost for 314 days	13,074.96	9,024.36	6,700.76	5,447.90	4,921.01	3,121.16	785.00
Saving in operating cost per year (314 days): Compared to:							
Duplex simple	.....	$4,050.60	$6,374.20	$7,627.06	$8,153.95	$9,953.80	$12,289.96
Duplex compound	.....	.....	2,323.60	3,576.46	4,103.35	5,903.20	8,239.36
Flywheel twin	.....	.....	.....	1,252.86	1,779.75	3,579.60	5,915.76
Cross compound noncondensing	.....	.....	.....	.....	526.89	2,326.74	4,662.90
Electric driven	.....	.....	.....	.....	.....	1,799.85	4,136.01
Cross compound condensing	.....	.....	.....	.....	.....	.....	2,336.16
First cost (approximate)	$3,100.00	$4,100.00	$7,400.00	$7,700.00	$4,600.00	$8,100.00	$5,200.00
Additional investment: Compared to:							
Duplex simple	.....	$1,000.00	$4,300.00	$4,600.00	$1,500.00	$5,000.00	$5,100.00
Duplex compound	.....	.....	3,300.00	3,600.00	500.00	4,000.00	4,100.00
Flywheel twin	.....	.....	.....	300.00	.....	700.00	800.00
Cross compound noncondensing	.....	.....	.....	.....	.....	400.00	500.00
Electric driven	.....	.....	.....	.....	.....	3,500.00	3,600.00
Cross compound condensing	.....	.....	.....	.....	.....	.....	100.00

Neilan finds a common denominator for Instrument Control



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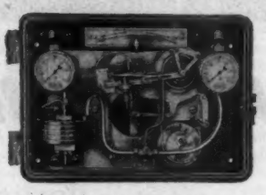
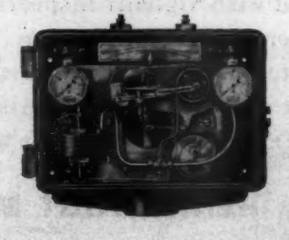


PRESSURE



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Continuous Clay Method of Treating Gasolines Assures Products of High Color Stability

By C. O. WILLSON

As the result of several years of research and development work, the Imperial Oil Refineries, Ltd., is now using a continuous clay method for treating cracked gasolines in the manufacture of high quality motor fuels at five of its Canadian refineries. Starting in its laboratories in 1925, the company began an investigation of the use of clay as a polymerizing catalyst and absorbent medium and the following year the first commercial unit incorporating the countercurrent clay method of treating was installed at the company's Sarnia, Ontario, refinery.

The commercial application has been gradually extended and perfected. Three additional units have been installed at the Sarnia refinery and the first installation enlarged. Two units are in operation at the company's Montreal refinery and one each at the Halifax, Regina and Calgary refineries. One unit is also in successful operation at a refinery of an affiliated company located at Talara, Peru. The flexibility of the treating process is indicated in these installations. The pressure distillates from which the finished gasoline are refined, are obtained from cracking plants of the Tube and Tank type but the charging stocks vary widely in properties, and this is reflected in the chemical treatment necessary to secure a uniform finished product. This problem has been solved satisfactorily with the clay treating.

Principal Advantages

The two principal advantages claimed for the continuous clay treating method are:

1. A finished motor fuel of high color rating which is stable meeting all marketing requirements. In these respects there has been a marked improvement over the previous operation in which an acid treatment of pressure distillate was used followed by rerunning with fire and steam.

2. The losses involved with the clay method are one-tenth those of the acid treatment.

While the process is not involved in design it will be apparent to plant operators making a study of this description that a great deal of experimental work was necessary both in laboratories and the plants before the operation was placed on its present economical and flexible basis. Technicians of the Imperial company first had the problem of providing for the countercurrent treatment of the gasoline from the pressure distillate with clay around which the entire operation centers. To assure economical operation it was then necessary to devise a method by which the clay and gasoline could be fed into the unit and the clay removed from the treating tower in one continuous operation. Finally it was necessary to adapt the process so that the cheaper fine mesh clays would be used.

A conventional bubble tower for a treating tower was adopted making provision for the charging of finely ground clay in the form of a slurry to the top plate and withdrawing the spent clay from the bottom plate. Thus, countercurrent flow was provided, and the process was made continuous.

Laboratory work along this line was undertaken early in 1925, and in a few months' time had progressed to the point where a small clay tower was designed and built to work in conjunction with an experimental still.

Several runs were made in this semi-commercial sized continuous clay treating tower, and the process being demonstrated as sound, one of the rerun stills at Sarnia refinery was provided with a tower and the necessary auxiliary equipment.

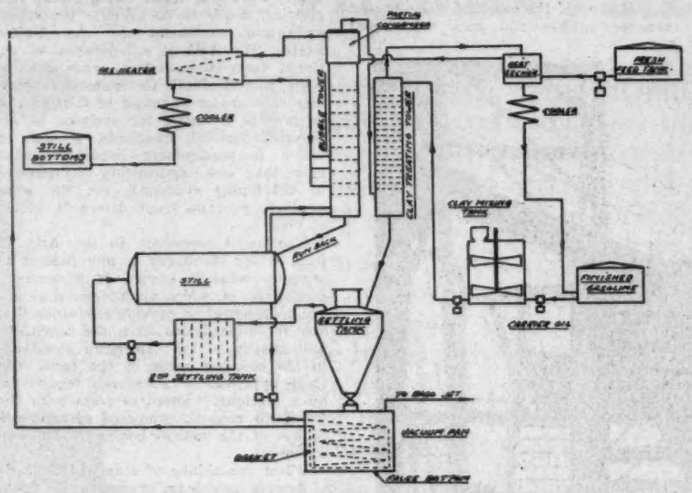


Diagram showing method used by Imperial Oil Refineries, Ltd., in in clay treating of cracked gasolines at Canadian refineries

Description of Equipment

Many of the details of the installation made available by the engineering department of the Sarnia refinery are shown in the accompanying diagram. From this it can be seen that the treating plant consists essentially of:

1. A treating tower constructed in the same manner as a bubble tower.
2. Means for mixing the slurry of clay and carrier oil, and the pumping of the slurry into the treating tower.
3. Settlers where the clay settles from the oil which is returned to the still.
4. Means for drying and dumping the spent clay.

Each of the above is described in detail in the following paragraphs:

1. Treating Tower.—The treating towers are 37 feet high and 7 feet 7½ inches in diameter. They are equipped with 15 plates each containing 114 bell caps per plate. The plates are spaced 2 feet apart but the top plate has been placed approximately 6 feet below the top of the tower to permit entrained clay and carrier oil to settle out of the vapor. The downspout, carrying the polymers, carrier oil and spent clay from the bottom plate, is led outside the tower so that these materials may be piped to the settlers.

2. Mixing Tanks and Slurry Pumps.—The clay mixing tanks are 7 feet in diameter and 8 feet high. These tanks are provided with paddles which rotate at sufficient speed to keep the clay suspended uniformly in the light distillate used as a carrier oil. Suction is taken on the bottom of the tank by a small triplex plunger pump equipped with ball valves. This pump is belt driven through a variable speed (Reeves) transmission, so that the quantity of the clay slurry discharged by the pump into the treating tower may be varied. One-fourth-inch mesh screen is placed in the pump suction to remove bits of paper and other foreign materials which would cause trouble in the pump.

3. Clay Settlers.—The spent clay slurry from the treating towers is conducted to a cone bottom settling tank 7 feet in diameter. The cone angle is 60 degrees and the total height of the tank, including the cone, is 9 feet 2½ inches. The cylindrical section of the tank is provided with a gauge glass. The slurry enters the side and in order to make the settling time as long as possible a series of baffle plates are fitted in the upper cylindrical section of the tank so that the path of flow for the slurry is lengthened. The oil, free from all but the finest particles of clay, leaves the conical settling tank and is further settled in an auxiliary settling tank where the last trace of clay precipitates from the oil, before the latter is returned to the distillation unit.

4. Spent Clay Drying Equipment.—Below the conical settling tank and separated from it by a large Merco Nordstrom cock is a vacuum pan, consisting of a tank 5 feet 6 inches in diameter and 4 feet 6 inches high. The bottom of this pan is held in place by bolts, but on removing the bolts, it may be lowered to ground level by means of a pneumatic plunger arrangement. This bottom plate supports a cylindrically shaped basket, 5 feet in diameter and 3 feet 4 inches high, made of wire cloth. Suspended from the roof of the vacuum pan is a coil of pipe, so located that it fits inside the basket when the latter is held up in place by the bottom cover of the pan.

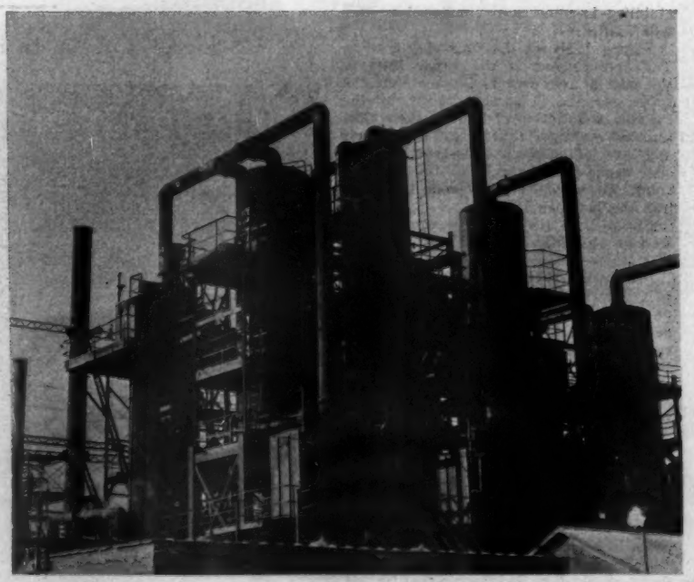
Periodically a certain amount of the clay settled in the bottom of the conical tank described above is dropped into the basket by opening the Merco-Nordstrom cock, until the basket is judged to be full. Any oil seeping out of the clay in the basket is drained away to the auxiliary settling tank.

When the basket is full, bottoms from the still are circulated through the coil and vacuum applied to the pan, thus distilling the absorbed oil from the clay, making it thoroughly dry. The vacuum is then broken with steam and the basket of dry clay lowered to the ground on the bottom cover plate. The basket is picked up by a hoist and dumped in the spent clay hopper.

Operation Described

In operation at Sarnia the pressure distillate is first lye-washed to remove hydrogen sulphide and is then fed to the still. As shown in the diagram, the feed is preheated in a vapor heat exchanger and in the partial condenser placed at the top of the bubble tower. It is further preheated in a bottoms heat exchanger before entering the 9-plate tower about the third plate from the bottom. The liquid still temperature is held about 150° F. higher than the vapor temperature at the top of the fractionating tower to assure on the one hand, the proper

Pressure Distillate Rerun Unit at Imperial Refinery



Installation for rerunning pressure distillate at Sarnia, Ont., refinery of Imperial, showing equipment for continuous clay treating

stripping of gasoline fractions from the still bottoms, and on the other, a vapor free of undesirable heavy ends for treatment in the clay tower. This latter is extremely important, for it has been shown experimentally that the higher the boiling point the larger the quantity of clay required for color stabilization.

The fractionated untreated vapor enters the clay tower below the bottom plate and after contacting progressively with fresher clay during the upward travel from plate to plate, finally leaves the top of the tower and goes to the condenser.

The clay mixing tanks are charged with fine clay (99 per cent through 100-mesh) and finished naphtha of whatever nature available, the proportions being adjusted so that each foot of liquid in the mixing tank, i.e., 24 gallons, contains 350 pounds of clay.

With a normal still running rate of 80-100 bbls. of overhead per hour, the slurry pumps are adjusted to feed 10 to 12 inches of slurry per hour to the top plate of the clay tower. This slurry works down the tower from plate to plate, in the same manner as reflux in the usual type of bubble tower, and is thus in countercurrent flow to the vapors which enter the treating tower at the bottom and leave at the top.

Disposal of Spent Clay

The spent clay from the bottom of the tower settles out of the carrier oil in the conical settlers. Periodically the operators open the cock at the bottom of the conical settler to drop settled clay into the basket in the vacuum pan. As an aid in gauging the quantity, the operator permits the level in the gauge glass on the settler to drop 2 inches. He also notes the time required for the level in the gauge glass to recover its former value, an undue length of time being taken as an indication that the tower is plugging. Under these conditions, the stream is cut to slop, and clear distillate without clay in suspension, is pumped to the top of clay tower at a good rate in order to flush the plates.

By means of a colorimeter, placed near the tailhouse, the operator determines the color of the stream periodically. The clay slurry tank is gauged at frequent intervals also in order to check the quantity of clay added to the tower.

The clay consumption rate averages 3.5 pounds of clay per barrel of finished 410° F. boiling point gasoline. While smaller quantities of clay will stabilize the gasoline so far as gum formation is concerned, the relatively large quantity of clay is required to insure the desired color stability of the gasoline when held in storage for periods up to a year. Where the endpoint of the gasoline is lower, the turnover quicker and such exceptional stability is unnecessary, much less clay will suffice.

Figure 1 shows the four clay towers. The arrangement of the vapor lines of the nearest clay towers is such that the tower may be by-passed readily by the suitable installation of blind gaskets. The four towers were built at different times and are of different construction and size, representing stages in the development. The second tower from the right was the last one installed.

Figure 2 is a view of the conical clay settlers and the vacuum pans.

Conical clay settler and vacuum pan clay rerun battery at Sarnia refinery

EGLOFF WRITES NEW BOOK

A new book on oil, interesting to the public as well as to the oil trade, has been written by Dr. Gustav Egloff, director of research for the Universal Oil Products Co. of Chicago. The title of the publication is "Earth Oil." It is being published by the Williams & Wilkins Co., Baltimore, Md., in connection with the Century of Progress exhibition at Chicago this summer.

The 158-page book is well printed and is profuse with illustrations. The subject matter is presented by Doctor Egloff in a style which educates with a minimum of effort and a maximum of interest. The history of the oil industry from the earliest days to the present is set forth in a manner which grips the imagination and provides authoritative information.

Advocates International Standardization in Testing of Petroleum Products

By R. P. ANDERSON
American Petroleum Institute

There are in this country many organizations that develop standards of one kind or another, and, in addition, the American Standards Association, commonly known as ASA, which serves as a clearing house to co-ordinate the standardization movement in the United States. The ASA is a federation of national technical societies, trade associations and Federal Government departments. A major function of the ASA is to provide a forum for arriving at national industrial standards, a function which is particularly important when more than one organization is interested in developing standards for the same product, perhaps from divergent points of view.

The usual procedure in the ASA in formulating standards in any field is to organize what is known as a sectional committee, on which all interested groups are represented to provide assurance that any recommendation from the committee will qualify as an "American standard" in the broadest sense of the term. The final approval of standards formulated by a sectional committee rests with the standards council, composed of representatives of the member-bodies of the association.

When one thinks of standard methods of testing petroleum products and lubricants in this country, the American Society for Testing Materials and its Committee D-2 on petroleum products and lubricants naturally come to mind. There are now in existence 24 A.S.T.M. standard methods and 14 A.S.T.M. tentative standard methods that are under the jurisdiction of Committee D-2.

The personnel of Committee D-2 is broadly representative of producing, consuming and general interests and meets the requirements of an ASA sectional committee; in fact it has been accepted as ASA Sectional Committee Z-11 on nomenclature and methods of testing petroleum products and lubricants with identical personnel, thus simplifying the procedure of obtaining ASA approval on A.S.T.M. methods. There are now 24 American standards and six American tentative standards covering the testing garding the standardization procedure of the various participating countries and the distribution of the existing standard of petroleum products and lubricants. In this connection it is of interest to note that all of the A.S.T.M. standard methods on petroleum products and lubricants have also been adopted as standard by the American Petroleum Institute.

Many foreign countries have national standardization bodies corresponding to our American Standards Association, and in 1926 a federation of these national standardizing bodies known as the International Standards Association (ISA) was founded. The purpose of the ISA is the systematic exchange of information on standardization work accomplished or in course of development in the different countries, and the promotion of uniformity in the various national standards, wherever this appears to be feasible and desirable. The membership consists of the national standardizing bodies in the following 18 countries: Austria, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Holland, Hungary, Italy, Japan, Norway, Poland, Rumania, Russia, Sweden, Switzerland, and the United States.

There has recently been created and is now in process of organization ISA Committee 28 on nomenclature and methods of testing petroleum products and lubricants, with many of the European national standardizing bodies and the ASA as members. The secretariat of this international committee has been assigned to the ASA and the ASA has in turn designated the writer its representative on the committee because of his position as secretary of A.S.T.M. Committee D-2 and ASA Committee Z-11. The preliminary program of the committee includes the compilation of information remethods of each country to each of the other countries.

There has been a limited degree of activity on the part of certain groups in Europe to promote international standardization through other agencies, in particular through a revival of the International Petroleum Commission, but the sentiment in this country appears to be unanimous in support of the ISA as the organization best suited to foster this sort of development.

There are many obstacles in the path of international standardization, but it seems obvious that even the mere interchange of information will be helpful, and that some progress at least may be expected.

Largest Oil Tubular Heater Now in Operation

Inside view of installation recently completed at West Tulsa refinery of Mid-Continent Petroleum Corp., by Foster Wheeler Corp. The heater is 72 feet long and 52 feet wide

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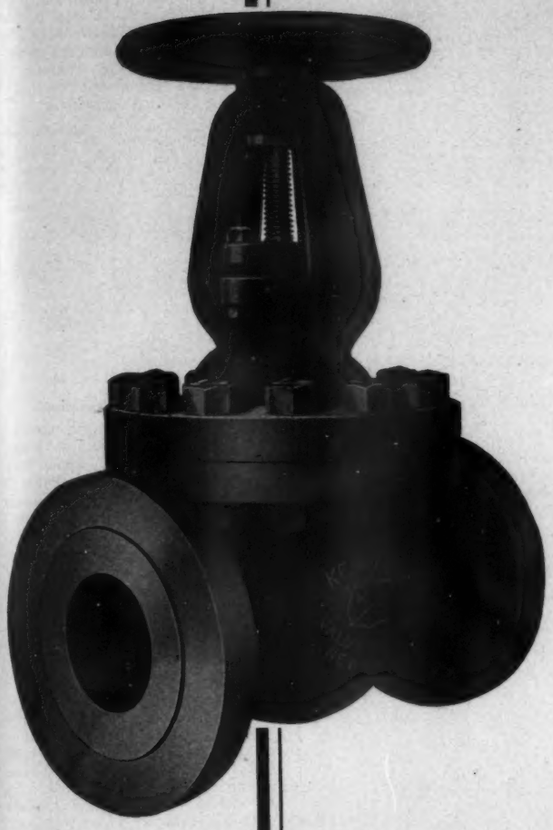

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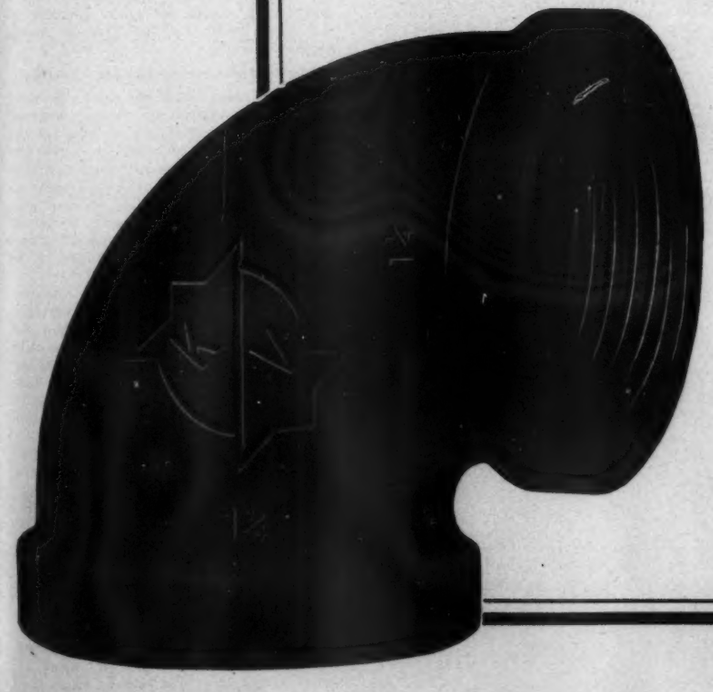

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Application of Inhibitors to Cracked Gasoline Is Significant Development in Plant Operation

By GUSTAV EGLOFF, J. C. MORRELL, C. D. LOWRY, Jr., and C. G. DRYER
Universal Oil Products Co. Research Laboratories, Chicago

One of the most significant developments in petroleum refining is the commercial application of inhibitors to cracked gasolines. In some refineries they have made possible the partial or entire elimination of treating. By use of inhibitors millions of dollars have already been saved. Development of the full possibilities of their use will result in economies much greater than those already achieved.

Inhibitors prevent cracked gasolines from deteriorating in color, gum and knock rating during storage. Inhibitors eliminate or reduce the cost of refining agents, and the loss of gasoline due to polymerization. They also make unnecessary, or substantially reduce, the cost of treating plants.

The deterioration of cracked gasoline is primarily an oxidation process, caused by gasoline contacting with air. An inhibitor is in effect a "chemical policeman" which prevents oxidation of the gasoline.

Results of using an inhibitor in commercial gasolines are presented in this report.

It shows that an inhibitor reduces the copper dish gum of most gasolines to a low value, even when the gum is initially high. It shows the superior storage stability of gasolines which have been inhibited over refined gasolines. Moreover unstable, untreated products, after addition of an inhibitor, can be stored for long periods of time without formation of gum, significant change in color or loss in octane rating.

Inhibitors in Untreated Gasoline

The data presented in Table 1 shows storage tests of a Pennsylvania cracked gasoline. This gasoline was divided into three portions, one untreated and uninhibited, one untreated and inhibited and the other treated in vapor phase by fuller's earth.

As will be noted the inhibitor reduced the copper dish gum from 259 to 19 mgs., a lower figure than that of the treated sample.

The inhibitor preserved the untreated gasoline for seven months without increase in gum, with a drop of only one point in octane number, and little color deterioration. During the same period, the uninhibited refined sample showed a considerable increase in gum and a three-point loss in octane rating, while untreated gasoline darkened in color, lost four octane numbers and became very high in gum.

Additional experiments at this refinery showed that the efficiency of the inhibitor in gasoline was not affected by doctor sweetening, or caustic washing provided these processes are carried out before the addition of the inhibitor. It was also unaffected by the addition of a dye or tetraethyl lead. All the inhibited gasolines, as will be seen in Table 2, gave long induction periods, and low gum, no matter how they have been handled, indicating satisfactory storage stability.

Similar results were obtained with the gasolines for which data is given in Table 3. These gasolines were untreated, except for a caustic wash or sweetening. They were initially high in copper dish gum, but with the inhibitor were low in gum, and had induction periods indicative of many months' stability in storage.

Tests made using a Mid-Continent gasoline are shown in Table 4. Previous practice with this stock had been to acid treat and rerun a pressure distillate, and sweeten the gasoline. The data on the treated product, with and without an inhibitor, are shown in the column "Acid treated." A satisfactory product was also produced by taking an endpoint distillate directly from the cracking unit and adding an inhibitor. It will be seen in the table that the inhibited product is low in gum, and has a long induction period, indicating long storage life. The use of an inhibitor has eliminated the acid treating and rerunning operations.

TABLE 1—INHIBITOR IN PENNSYLVANIA CRACKED GASOLINES

	Untreated		Fuller's earth treated uninhibited	
Gravity, °A.P.I.	58.9		60.3	
A.S.T.M. distillation:				
Initial boiling point	93° F.		98° F.	
10 per cent	148		140	
50 per cent	256		250	
90 per cent	340		334	
Endpoint	368		370	
Octane number	69		70	
Universal inhibitor, per cent	None		0.05	None
Color	18		18	25
Gum, mg./100 cc., copper dish	259		19	29
Induction period, min.	120		380	85
After one month:				
Color, Saybolt	17		17	25
Gum, mg./100 cc., copper dish	176		10	17
Octane number	69		69	69
After three months:				
Color, Saybolt	14		18	25
Gum, mg./100 cc., copper dish	142		7	27
Octane number	67		68	68
After seven months:				
Color, Saybolt	1		13	22
Gum, mg./100 cc., copper dish	239		7	99
Octane number	65		68	67

TABLE 2—INHIBITOR IN VARIOUSLY TREATED PENNSYLVANIA GASOLINES

	Sour	Sweet	Untreated	Caustic washed	Dyed	Untreated	Ethylized 3 cc./gal.
Gravity, °A.P.I.	65.5	62.4	63	....	....	61.6	....
Specific gravity	....	....	...	....	....	....	....
A.S.T.M. distillation:							
Initial boiling point	70	87	79	....	....	85	....
10 per cent	125	132	129	....	....	130	....
50 per cent	250	244	258	....	....	270	....
90 per cent	....	363	....	....	....	360	....
Endpoint	396	396	376	....	....	378	....

Universal inhibitor, %	None	.05	None	.05	None	.05	None	.05	None	.05	None	.05
Color	14	14	14	14	16	16	16	16	..	..	..	..
Gum, mg./100 cc., copper dish	45	2	57	3	48	5	92	3	48	3	260	6	264	5
Induction period (min.)	175	510	110	485	170	565	70	425	170	565	125	510	125	510

TABLE 3—INHIBITOR IN UNTREATED GASOLINES

	Untreated cracked gasoline	Caustic washed untreated	Reformed gasoline sweetened	Reformed heavy naphtha sweetened
Gravity, °A.P.I.	55.7	57.8	59.4	54.7
A.S.T.M.-100 c.c. Distn.				
I.B.P., °F.	118	102	100	102
% Distilled over:				
10	160	142	157	182
50	269	256	262	284
90	376	370	366	356
E.P.	398	396	396	400
Octane number	...	...	74	76

Universal inhibitor, %—	None	.025	None	.025	None	.025	None	.05
Color	14	14	15	16	15	...	12	...
Gum, mg./100c.c. (copper dish)	301	90	135	0	108	6	242	20
Induction period (min.)	240	480	195	420	30	180	30	165

TABLE 4—INHIBITOR IN MID-CONTINENT GASOLINE

	Acid treated	Untreated				
Gravity, °A.P.I.	55.5	52.5				
A.S.T.M. 100 c.c. Distn.						
I.B.P., °F.	122	129				
% Distilled over:						
10	179	181				
50	274	304				
90	381	398				
E.P.	412	419				
Octane number	68	67				
Univ. inhibitor, %	None	.05	None	.05		
Color	21	18	18	16		
Gum, mg./100 c.c. copper dish	59	19	426	11		
Induction period (min.)	225	810	260	630		

TABLE 5—STORAGE OF INHIBITED AND UNHIBITED TREATED GASOLINES

	Mid-Continent Fuller's earth treated		Mid-Continent Acid treated		Pennsylvania Fuller's earth treated	
Initial properties—						
Gravity, °A.P.I.	63.2		57.7		61.3	
A.S.T.M. Distillation						
I.B.P., °F.	96		97		96	
% Distilled over:						
10	133		156		136	
50	246		274		242	
90	362		373		332	
E.P.	392		394		362	
Octane number	76		69		70	
Universal Inhibitor, %	None	.01	None	.01	None	.01
Color, Saybolt	30	29	28	27	30	30
Gum, mg./100 c.c., copper dish	178	14	112	15	2	6
Air jet	0	0	0	0	2	6
Induction period (min.)	240	360	425	630	60	255
Properties after 1 month—						
Color, Saybolt	30	26	28	25	30	30
Gum, mg./100 c.c. copper dish	115	57	44	11	63	5
Air jet	4	2	0	4	6	4
Octane number	76	75	69	69	70	70
Properties after 3 months—						
Color, Saybolt	30	28	27	26	27	30
Gum, mg./100 c.c. copper dish	345	12	146	74	97	2
Air jet	4	6	4	6	4	6
Octane number	75	74	68	68	69	70
Properties after 6 months—						
Color, Saybolt	30	26	24	25	26	30
Gum, mg./100 c.c. copper dish	219	76	157	132	415	10
Air jet	10	2	10	4	134	4
Octane number	71	73	68	69	60	70

TABLE 6—INHIBITOR IN OTHER TREATED GASOLINES

	Treated "Vapor phase"			Treated "Vapor phase"			Acid treated Mid-Continent	
Gravity, °A.P.I.	58.0			58.1			61.2	
A.S.T.M. Distillation								
I.B.P., °F.	93			92			95	
% Distilled over:								
10	127			156			133	
50	246			250			244	
90	350			365			360	
E.P.	406			460			392	
Octane number	78			77			73	
Universal Inhibitor, %	None	.01	.05	None	.01		None	.01
Color, Saybolt	18	18	18	26	25		20	20
Gum, mg./100 c.c. copper dish	282	69	10	46	13		72	26
Air jet	0	..	..	2	..		6	0
Induction period (min.)	240	315	450	120	255		180	240

Inhibitors in Treated Gasolines

Inhibitors find application in treated as well as untreated gasolines. Some treated gasolines are high in copper dish gum or unstable in storage. In Table 5 examples are given of several such gasolines which were stored with and without addition of the Universal inhibitor. It will be noted that in the proportion of .01 per cent the inhibitor sharply lowered copper dish gum and increased storage stability. In six months' time the uninhibited gasoline increased in gum and dropped in color and knock rating while the inhibited samples showed practically no deterioration.

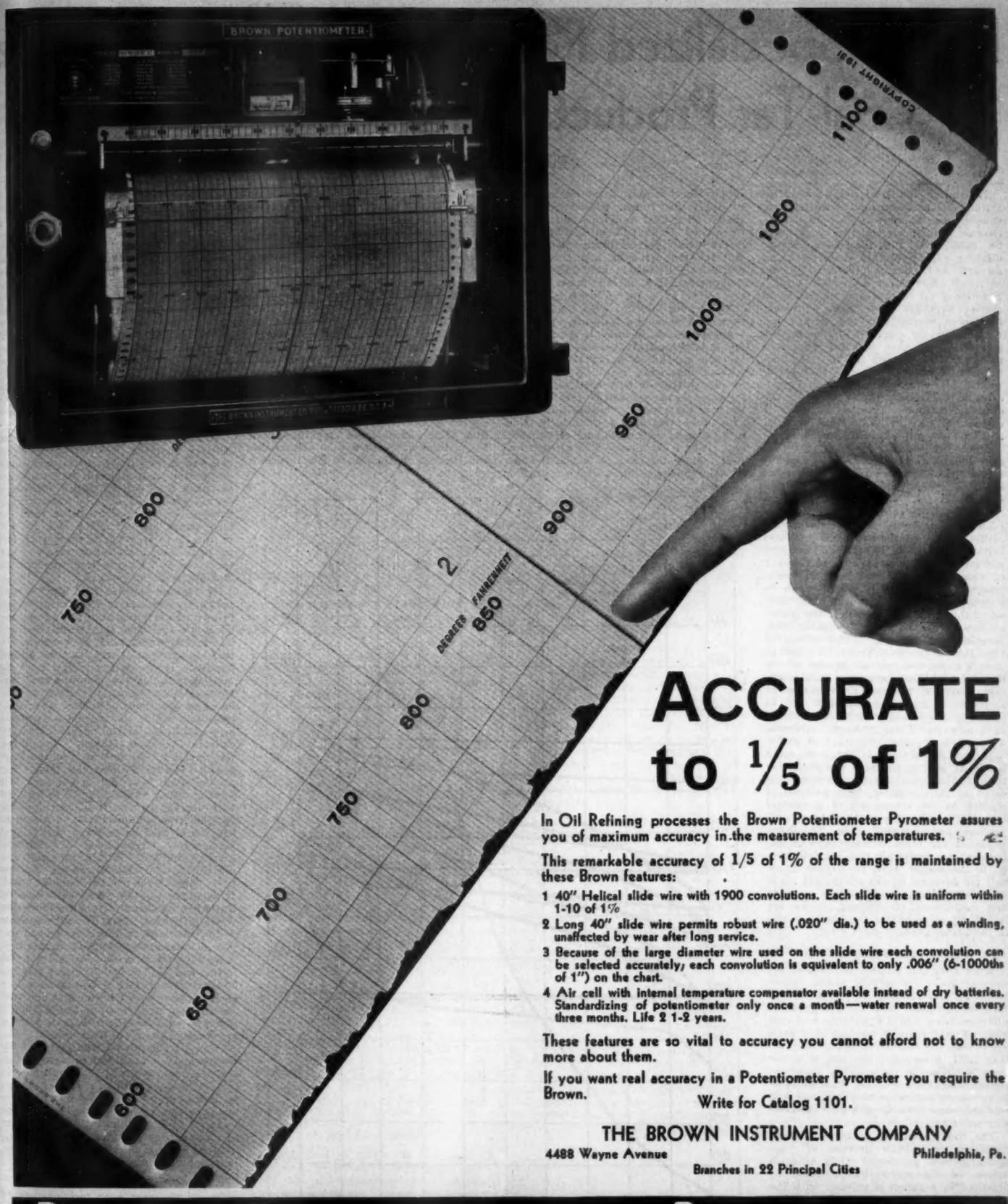
The response of a number of other gasolines to inhibitor has been determined in this laboratory. In Table 6 representative examples are given, two of them being products of so-called vapor phase cracking, and fuller's earth treated, and the other a Mid-Continent acid treated gasoline. Comparison with data already given on storage tests indicates that the induction periods of the inhibited gasolines in Table 5 are sufficient to insure their being stable for many months in storage, without forming gum or losing antiknock value.

Use of Inhibitor to Reduce Treating

With certain gasolines some chemical treatment is necessary; usually because water white color or low sulphur is demanded. But even in such cases the use of an inhibitor may effect economies, for by adding an inhibitor after treatment to keep gum low and impart storage stability, milder treatment may be given than would otherwise be necessary, and saving in chemicals and reduction in treating losses may be effected.

A satisfactory inhibitor for commercial use in gasoline must have a number of properties besides ability to prevent gasoline deterioration. It must be readily soluble in gasoline, so that its application will be simple. It should not be materially soluble in water, else contact therewith, which is almost unavoidable in the commercial stage of gasoline, may remove it and leave the gasoline unprotected. It must not impart color to the gasoline and should prevent color deterioration. It must be sufficiently volatile to vaporize with the gasoline, and should preferably be a liquid. A volatile liquid cannot form deposits in carburetor jets or elsewhere in the intake system of the motor, as nonvolatile solid inhibitors have a tendency to do.

The commercial inhibitor used in the tests reported fulfill the requirements just mentioned and is being used in many refineries at the present time.



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Highly Specialized Petroleum Naphthas Replace Coal Tar Products in Paint and Lacquer

By R. C. CONINE

Expanding industrial requirements for suitable solvents and liquid vehicles have caused manufacturers to turn to the petroleum refiners for materials which may be substituted for the older lacquer diluents, rubber solvents, extractors, wax solvents, and paint and varnish thinners, of which there is an inadequate supply. Practically all of the early objections to special naphthas made from petroleum have been overcome in the solvent and thinner field by a species of compromise, and the work that is being conducted today by technologists for the manufacturers and refiners indicates that petroleum naphthas produced by special processes may soon be available to replace the older solvents and diluents completely if desired. It may be of interest to note, too, that the refiners in a number of instances, are working not only to produce "high solvents," but also to manufacture suitable varnish and other resins in connection with their usual pyrolytic operations.

The development of nitro-cellulose finishes and modern synthetic resin varnishes have revolutionized basic processes involving the use of solvents and diluents and the specifications covering the quality of these materials have been increased many fold. When the refiner began to supply the industrial trade he could meet all of the requirements with three grades of kerosene, six grades of naphtha, and three or four grades of well fractionated high gravity gasoline. Today, in order to meet competition on all grades of industrial naphthas, the refiner must maintain stocks of at least three grades of kerosene, 15 grades of naphthas, and at least six grades of closely fractionated light solvents. These products command a premium in price over that of motor fuel, but the margin is far from clear profit as selling expenses are high due to specialization and expert services rendered to the consumer. The material is subject to the acceptance of a critical laboratory and consequently frequent rejections are incurred. The petroleum naphthas are often formulated with expensive raw materials and too frequently, in the earlier days, the refiner faced suit for damages due to alleged off grade material. Today, specifications on bids and inspections of shipping stocks are watched very closely as the first requisite of industrial naphtha marketing.

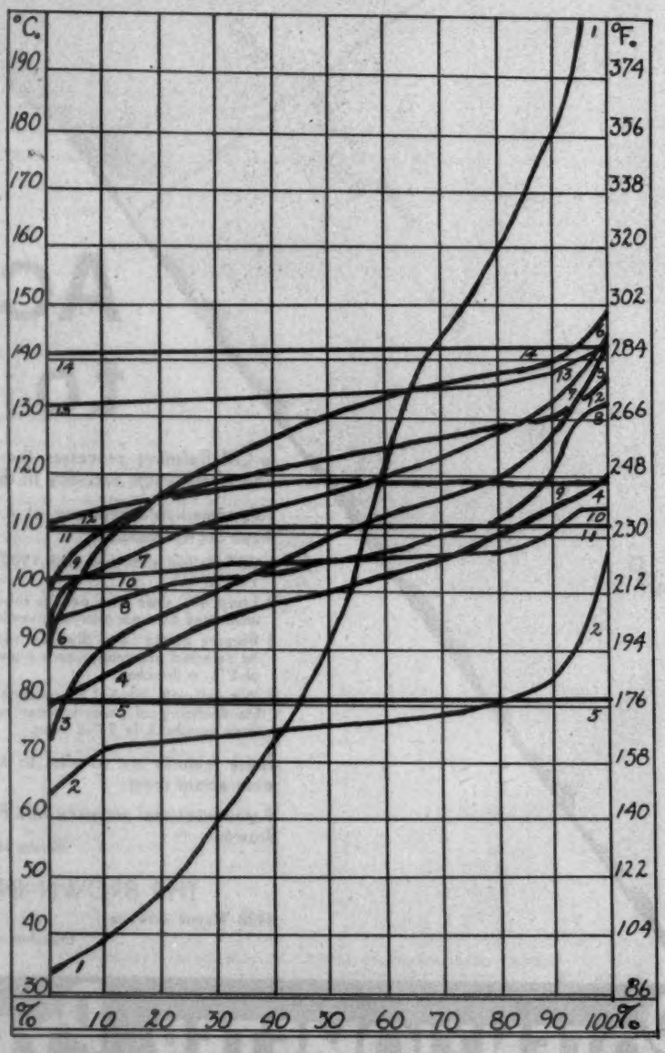
Solvency and Dilution Ratio

Even after full account is taken of the natural desire for secrecy among manufacturers and refiners in the matter of formulating paint and varnish products and producing suitable solvents and carriers, it is surprising to find how little appears in the literature, particularly before 1931, concerning the use of petroleum naphthas in these fields. However, considerable work is being done by technologists on both sides and this year will probably see a number of highly informative reports.

The first pyroxylin, or nitro-cellulose, varnishes gave little promise of commanding wide popularity. Only about 6 ounces of the nitro-cellulose could be dissolved in a gallon of solvent, with the result that the product proved much too thin. The real beginning for the type of pyroxylin finishes now known as "Duco," was the discovery that by suitable treatment the nitro-cellulose could be modified so that several times more than formerly could be dissolved in a given volume of solvent. This modification was brought about by placing the nitro-cellulose in a steam boiler for a time with a quantity of pure water under heavy pressure. The solvents in "Duco" dry too rapidly for brushing, so sprays are used to apply the finish. Sabin points out that if oil is used to aid brushing quality there is danger that the oil will be soluble in the "Duco" solvent to an extent which will rob the pyroxylin and cause it to precipitate. Petroleum naphthas used in the production of nitro-cellulose finishes are known as lacquer diluents.

"A lacquer diluent," says O. R. Brunkow, of Commercial Solvents Corp., "is a product which, in itself, is not a solvent for cellulose nitrate but may be added to such a solution in suitable amounts without impairing its utility. Diluents consist chiefly of hydrocarbons, and in the early development of lacquer enamels, the coal tar products, benzol, toluol and xylol were used almost exclusively. Due to its toxicity and rapid rate of evaporation, benzol was soon eliminated from good lacquer formulae. Although the use of xylol has continued, its evaporation rate is so slow that it can be used to only a limited extent. Tuluol has all the characteristics of a good diluent and its use soon became universal in lacquer."

When the early objections to the use of petroleum naphthas as substitutes for toluol, turpentine and similar products, were brought forth, the petroleum naphthas referred to were straightrun products of crude oils of no "special" properties. One such petroleum naphtha had an initial of 95° F. and an endpoint of 392° F. These petroleum products, naturally, give a much lower dilution ratio than toluol with all of the usual solvents; the wide evaporation range makes it necessary to use a quantity of very slow evaporating solvent to prevent late precipitation of nitro-cellulose in the drying film. These straightrun naphthas have low solvent power for oils and resins, and lacquer solutions have low tolerance for them.



Distillation characteristics of petroleum naphthas and coal tar diluents, included are amyl and butyl acetate and butyl alcohol. Coal tar diluents are 14. orthoxylol; 11. toluol, and, 5. benzol. The active solvents are 6. amyl acetate; 9. butyl acetate, and 12. butyl alcohol. The V. M. & P. naphtha curve, No. 1, is included for comparison. No. 2 is a vapor phase product which replaces benzol. Nos. 10 and 13 are Edeleanu extract substitutes for toluol and xylol, respectively

These objections apply but slightly, if at all, to the petroleum naphthas produced by experienced refiners today. A technologist of one of the larger companies points out: "With the advent of the nitro-cellulose lacquer, new problems were presented to the refiner. As petroleum solvents carry a better odor and less toxicity than the coal tar products, it soon became common practice to substitute, and consequently in addition to the old requirements of gravity, distillation, sulphur, color, odor, etc., the lacquer manufacturers were asking for additional data covering such tests as the following, dimethyl sulphte, kauri butanol, aniline point, and the effect of the solvent on the body and viscosity of various solutions of synthetic resins."

It has become evident, this investigator believes, that the producer of petroleum paint thinners will be forced to abandon straightrun cuts and will have to select his stock from either hydrogenated bases, special crude oils high in aromatics, or extract the choice ingredients from his high octane cracked motor fuel. He will be forced to fractionate these cuts into products having a boiling range of not to exceed 60° F., and treat carefully to stabilize color and odor.

The special naphtha field offers a comparatively small market to the petroleum refiner who is accustomed to large volume of motor fuel and heating oil business. The accompanying chart showing the distillation ranges of the various special naphthas serves as an indication of the mutilation which the "gasoline cut" may undergo when special naphthas are produced as a refinery side line. The larger refiners are able to take out a few tank cars of 140 initial boiling point and 200 endpoint "lacquer diluent," and throw the remainder of the cut into the large gasoline storage without noticeable effect on the quality of the motor fuel. The smaller refiner would have to be satisfied with naphtha cuts on the high end of the gasoline fraction, usually, and his problem would then be to blend back a proportionately larger share of mutilated gasoline fraction. Within the past few months several Mid-Continent refiners have entered the special naphtha field. It is interesting to note that these refiners are reluctant to produce those cuts which will leave them too large a share of low and high boiling fractions to dispose of, and are specializing at this time in materials such as Stoddard solvent, 310 initial and 410 endpoint; paint thinner, 290-300 initial and 415 endpoint, and enamel reducer, 320 initial and 450 endpoint. A few are interested in the 200-330 cleaners' or V.M.&P. naphtha because it apparently offers a wide market. Experienced refiners shun the cleaner business because it is subject to racketeering, and because competitive conditions in this business have brought prices to nearly profitless levels. These fractions are also used in preference to kerosene for cleaning type, certain publishing houses in Chicago, for instance, using as much as three or four tank cars of type washing naphtha a month.

Increase Naphtha Specifications

Up to the past year technologists of the petroleum industry had not, it appears, openly challenged the designation of petroleum toluol substitutes as "aliphatic lacquer diluents." The discovery that the objection to V.M.&P. naphtha because of its low solvent power for oils and resins could be overcome by the addition of small quantities of active solvents, made it easier to forego costly experimentation for the purpose of producing a petroleum naphtha rich in aromatics and

unsaturated cyclic olefines. The "high solvent" petroleum naphthas were those produced from certain California and Gulf Coast crude oils.

The properties of straightrun paraffin base V.M.&P. naphthas as diluents were studied by Doctor Brunkow, who reports as follows: "The objection to the use of naphtha on the basis of its low solvent power is more apparent than real, and is shown to be without any foundation because the addition of solvents for cellulose nitrate, in amounts much less than that required to dissolve the cellulose nitrate in a lacquer, is enough to completely overcome this defect. Castor oil, either blown or raw, forms a turbid mixture when naphtha alone is added to it, but the addition of small amounts of butyl acetate, butyl alcohol or toluol forms a clear solution. One cubic centimeter of any one of these solvents cleared a mixture of 10 cc. of raw castor oil to which 20 cc. of naphtha had been added. In the case of blown castor oil, 5 cc. of butyl alcohol were required to clear the mixture.

"Most gums and resins are insoluble or only slightly soluble in naphtha (straightrun paraffinic), but a solution of gum in its solvent will tolerate more naphtha than would be used in practice, as indicated by the following table:

Resin and solvent—	Naphtha tolerated cc.
Ester gum No. 1, toluol	20
Ester gum No. 1, butyl acetate	22
Ester gum No. 1, butyl alcohol	77
Ester gum No. 2, toluol	2
Ester gum No. 2, butyl acetate	8
Ester gum No. 2, butyl alcohol	13
Ester gum No. 3, toluol	11
Ester gum No. 3, butyl acetate	36
Ester gum No. 3, butyl alcohol	60
Phthalic anhydride glycerol type:	
No. 1, toluol	6
No. 1, butyl acetate	6
No. 1, butyl alcohol	5
No. 2, toluol	9
No. 2, butyl acetate	8
No. 2, butyl alcohol	5
No. 3, toluol	17
No. 3, butyl acetate	19
No. 3, butyl alcohol	29

Doctor Brunkow, however, points out that the main obstacle to the use of naphtha in lacquer is the low tolerance of lacquer solutions for it. He presents a table in which a comparison is made of the dilution ratios with naphtha and toluol for some of the more common solvents and mixtures:

Solvent—	Naphtha	Toluol
Ethyl acetate	1.1	3.7
Butyl acetate	1.4	3.9
Amyl acetate	1.3	3.2
Cellosolve acetate	0.7	3.6
Cellosolve	1.0	5.3
Secondary butyl acetate	1.1	3.5
Ethyl lactate	0.8	5.8
Diacetone alcohol	0.4	3.4

"It is well known," Doctor Brunkow says, "that with toluol the dilution ratios of the acetates of the alcohol series decrease as their molecular weights increase. There is an exception to this rule when we come to naphtha. In this case there is an increase in tolerance from ethyl acetate to butyl acetate, after which the tolerance again decreases as the molecular weight increases."

More suitable straightrun naphthas are now available than those used in the above comparisons, but a far more promising source for greatly improved petroleum diluents are the high temperature cracking units and the hydrogenation process. In a letter an official of Commercial Solvent Corp. says: "Samples of naphtha recently received by us from Pacific Coast sources have been found suitable for use in nitro-cellulose solvents in much larger percentage than have the naphthas produced by Mid-Continent and eastern refiners. In other words, the commonly used lacquer solvents have a much higher tolerance for these Pacific Coast naphthas than they have for other naphthas."

It may be pointed out that some of these Pacific Coast high solvent naphthas are materials extracted from the sulphur dioxide used in selective treatment of California kerosenes, and are therefore rich in unsaturates and aromatics.

Before taking up the latest developments in the special properties sought in certain technical naphthas, the rapid increase in the number of specifications for special naphthas may be traced from the beginning. When gasoline was substituted for turpentine, in paint and varnish thinning, a number of pioneers lost their lives because of the uncertain qualities of the substitute. The fire hazard was finally removed with the development of two types of thinners, V.M.&P. naphtha and a heavy grade designated as oleum spirits by the major producer in this territory.

These thinners, particularly the heavier type, must have a fixed flashpoint in order to eliminate fire and explosion hazard. The oleum must be registered with the National Board of Fire Underwriters Laboratory as having a hazard in the same classification as kerosene. In order to produce finishes of unvarying characteristics even the gravity must be identical on all shipments and only one or two degrees variation in temperature allowed in the entire Engler distillation range in order to insure an absolutely uniform rate of evaporation. Sulphur readily enters into combination with the metallic driers present in varnish and attacks copper equipment. For this reason many tests have been devised by varnish chemists to insure the absence of sulphur in a form likely to cause trouble. Certain government agencies permit a slight tarnish only to a copper strip held in mineral spirits at its boiling point for a period of 30 minutes. Some varnish manufacturers do not permit a discoloration to a strip of filter paper saturated with lead acetate and placed in the neck of the condenser in contact with the vapor during the Engler distillation. Others require 100 cc. of the mineral spirits to be evaporated to dryness in a copper dish without showing appreciable blackening, tarnishing or gum formation.

The demands of the cleaning and dying trade can be met with two fractions, a volatile type with a boiling range from 200° F. to 350° F., and the heavy, or Stoddard type, with a range from 300° F. to 410° F. The first type is used extensively for home dry cleaning and by small, poorly equipped, dry cleaning plants, and its chief requirements are good odor and volatility. The volume of this business is small. The specifications of the Stoddard type are under the jurisdiction of the U. S. Bureau of Standards (CS3-28) and call for a maximum boiling point under 410° F., a flash over 100° F., Tag. closed, and an unsaturated hydrocarbon content of under 2 per cent. Good odor and volatility are also requisites. Supremacy of petroleum solvents in this industry is now being threatened by chlorinated solvents which can guarantee noninflammability and complete absence of odor.

Fat extraction offers an outlet for a limited amount of closely fractionated solvents whose boiling ranges are governed by the characteristic of the products extracted. One manufacturer advertises seven grades of solvents with ranges of temperature between the initial and maximum boiling points as narrow as 10° F. These products are often sold under the name of the hydrocarbon they most nearly resemble, that is, pentane, hexane, octane, and so on. The chemical characteristics of these solvents must be of a high order as they are often used for food extraction and for the production of high grade fats and oils that would be easily contaminated by traces of odor, sulphur or residue.

Solvency Tests

Tests used to determine the value of petroleum naphthas as diluents for nitrocellulose and synthetic resin solutions are the following: Kauri butanol solvency test, in which 100 grams of kauri gum are dissolved in 500 grams of butyl alcohol, settled, and decanted. To the clear solution, 20 grams in a 200 cc. Erlenmeyer flask, the solvent is titrated until the 10-point print appearing on a white paper placed under the Erlenmeyer is blurred. The number of cc.'s of solvent required to make the print illegible is taken as the kauri butanol of the solvent. Temperature is maintained at 77° F. The kauri butanol value should be 35 cc. or better.

The aniline point is the maximum temperature at which approximately equal quantities of the solvent tested and aniline can exist as two separate liquid phases. It is known as the critical solution temperature and should not be above 140° F.

A direct measure of the aromatics, olefines and diolefines present in the solvent under test is given by the dimethyl sulphate test. A hundred cubic centimeters each of the solvent and dimethyl sulphate are carefully mixed in a graduated column, and the amount of the solvent dissolved is the dimethyl sulphate value of the solvent, and should be high.

The dilution ratio test provides a measure of the tolerance of nitro-cellulose solvents for petroleum lacquer diluents.

Vapor Phase and Gas Polymerization

At least one large refiner is known to be working with every indication of eventual success on the production of petroleum diluents and solvents which will compare closely with hydrogenated products. Several other refiners are reported to be nearing commercial production of petroleum derivatives which have practically all of the characteristics of benzol. A survey of the work being done by petroleum technologists reveals that the special naphthas derived from petroleum in the future will bear little resemblance to most of the products marketed under this classification today. The cuts which will probably be on a commercial production basis before the close of this year may be taken from any type of crude oil and will have evaporation rates identical with those of the coal tar derivatives. The Engler distillation ranges will be very narrow, and the finished naphthas, while extremely rich in aromatics and unsaturates, will be free of gum trouble.

Test data are not available at this time on naphthas produced by blending closely fractionated distillates from vapor phase cracking units and refinery gas (fixed) polymerization installations, but it is understood that the results so far obtained are highly favorable. The test data given below are on naphthas produced from paraffin base crude oil which is characterized by the aliphatic and saturated nature of its hydrocarbons. The hard knocking Michigan crude oil is represented.

	No.1	No.2	No.3	No.4
Gravity	51.7	40.0	61.1	54.2
Dimethyl sulphate, %	18	16	34	16
Aniline point, ° C.	15.5	26.1	15.5	14.5
Color	†25	†20	†29	†25
Initial	214	287	148	180
10 per cent	224	324	163	212
20 per cent	228	346	165	220
30 per cent	231	354	166	226
40 per cent	234	360	168	228
50 per cent	237	366	170	237
60 per cent	240	372	173	246
70 per cent	244	377	175	257
80 per cent	249	382	178	273
90 per cent	257	388	196	298
95 per cent	266	393	195	332
Endpoint	290	418	225	382
Recovery, %	98.5	98.5	99.5	96.0

An indication of what may be expected from the pyrolysis of gaseous hydrocarbons in the production of high solvent naphthas may be seen in the report of H. P. A. Groll before the Denver meeting of the American Chemical Society last year. According to this investigator, "the tar obtained from the pyrolysis of these gases shows the same composition no matter from what gas it is made." A typical tar analysis given is as follows:

	Per cent
Benzol	37
Toluol	7
Xylol and styrene	4
Naphthalene	18
Substituted naphthalenes	3
Anthracenes and phenanthrene	10
Highest distillable hydrocarbons	13
Residue over 360° C. at 1.5 mm.	9

Practically all of the data published to date on the "high solvent" naphthas from petroleum cover products of the hydrogenation process and Edeleanu kerosene extracts from the Pacific Coast. C. G. Moore, in the paper presented by the Cleveland Paint and Varnish Production Club at the Washington meeting of the American Paint and Varnish Manufacturers Association last year, gives the results of tests made on these naphthas. The naphthas were produced by Union Oil Co. of California, Standard Oil Co. of New Jersey, and Shell Oil Co. of California. In dimethyl sulphate solvency value the materials ranged from 26 per cent to 73 per cent; in kauri butanol value the naphthas ranged from 55.5cc. to 79 cc., and the critical solution temperatures (aniline points) ranged from below minus 11° C to +16.4° C.

Mr. Moore's report covered investigations made on the effects of the naphthas on the body (viscosity) of synthetic resin products, while the investigations reported by Jeffrey R. Stewart in Circular No. 378, of the American Paint and Varnish Manufacturers Association, covered work done in connection with the use of petroleum naphthas in nitrocellulose lacquers. While Mr. Stewart states that "the tests performed have indicated that there really does exist a true relationship between the kauri butanol, aniline point, dimethyl sulphate and dilution ratio tests," Mr. Moore finds considerable evidence that this relationship is far from clear in connection with synthetic resin products. In fact, Mr. Moore points out that one of the naphthas tested showed comparatively low dimethyl sulphate and kauri butanol values and a comparatively high aniline point, but proved to be a superior solvent for all of the resins, one excepted, and two of the varnishes used. The aniline points in various cases moved in a direction opposite to that expected, and even the dimethyl sulphate and the kauri butanol tests were found to be uncomforming. One naphtha had a low dimethyl sulphate value and an excellent aniline point, with the solvency in keeping with the dimethyl sulphate value. Mr. Moore states: "The aniline points show a general trend in the same direction as the dimethyl sulphate values, but there are too many discrepancies to place reliance on this method. The kauri butanol values do not appear to tie in with any of the solutions or varnishes. These values do not even indicate any definite trend, as the aniline points do." From Mr. Moore's table the following comparisons may be made:

Edeleanu extract, 52 per cent dimethyl sulphate value; 74 cc. kauri butanol value, and 0° C. aniline point, added to the following resin and varnish solutions gave the following viscosities (Saybolt Universal): Amberol F-7, 550; 25 per cent rezyl, 550; 50 per cent rezyl, 470; Amberol varnish, 1,770; Bakelite varnish, 1,120-1,250.

Hydrogenation product with boiling range from 213° F. to 296° F., 73 per cent dimethyl sulphate value; 78 cc. kauri butanol value, and below minus 11° C. aniline point: Amberol F-7, 2,190; 25 per cent rezyl, 285; 50 per cent rezyl, 470; Amberol varnish, 1,650; Bakelite varnish, 1,570.

Low testing California naphtha (comparatively), 34 per cent dimethyl sulphate value; 59 cc. kauri butanol value, and plus 16.4° C. aniline point: Amberol F-7, 770; 25 per cent rezyl, too heavy; 50 per cent rezyl, 770; Amberol varnish, 1,650, and Bakelite varnish, 1,120-1,250.

Hydrogenated Solvent Naphthas

Recently P. J. Byrne, Jr., E. J. Gohr and R. T. Haslam announced the production of hydrogenated solvent naphthas of the following characteristics:

Fraction, ° F.	280–375	320–400	340–420
Gravity	34.7	33.7	35.6
Color	35	27	27
Aniline point, ° F.	—22	—50	—37
Dimethyl sulphate, %	100	100	100
Kauri butanol, cc.	74	78	80
Flashpoint, ° F.	82	107	126
Sulphur, %	0.02	0.02	0.02

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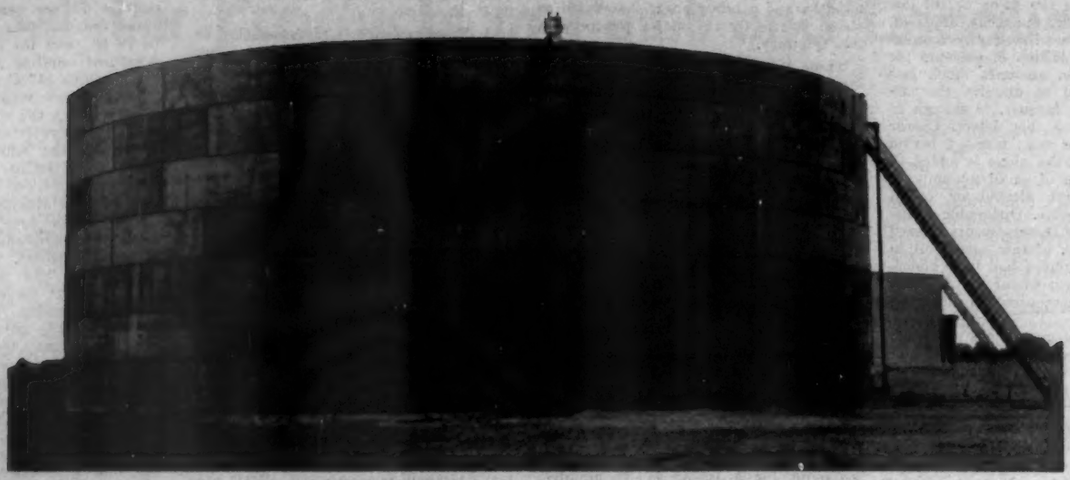

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Gain in Demand for Petroleum Asphalts Offers Refiners Opportunity for Substantial Profit

By GENE ABSON
Chicago Testing Laboratory, Inc., Chicago

The consumption of asphalts and asphaltic materials in the United States (exclusive of road oils) totals over 20,000,000 bbls. annually, and will steadily increase. This represents an important phase in the petroleum refining industry since practically that entire quantity is produced directly from crude oils or their residues.

The paving or road-building industry and the roofing industry are the largest individual consumers of asphaltic materials. The former requires about 45 per cent of the total production, the latter about 35 per cent, and the myriad of other uses consumes the remaining 20 per cent. Included in this last 20 per cent are such uses as waterproofing, mastic and other type floor coverings, pipe-line coatings, coal and coke briquetting, electrical and thermal insulation, wire and cable coverings, acid-proof linings, sealing compounds, molding compositions such as battery cases and electrical fittings, rubber compounding, paints, varnishes, enamels and japans, building paper, waterproofed packing containers and a host of other specialty uses too numerous to mention.

Asphaltic products are manufactured from petroleum residues either by distillation in the presence of steam (or under vacuum) or by oxidation with air, and common trade parlance differentiates them as either "steam refined" or "air-blown." The processes are distinctly different and not interchangeable because the characteristics of the finished products are direct functions of the process used in the manufacturing. The uses to which the finished materials may be adapted dictate which method of refining shall be used. There are no other commercial processes for the production of asphalts.

No data are available which segregates the quantities produced by the two refining methods, but it can be estimated that about 60 per cent is steam or vacuum distilled and 40 per cent oxidized. Some products are partially distilled and partially oxidized. The paving materials are for the most part straight distilled residues, with a slight period of oxidation for some grades during the final stages of processing. Road oils are not to be included in this discussion, so it will suffice to say that they are either straight distilled, liquid residues, cracking still residues, or blends of both. The roofing requirements are divided about equally between oxidized and distilled products, and the same holds true for the remaining uses.

History of Uses

Before discussing the details of the manufacturing processes, a brief history of the uses of asphalt may not be amiss, since it is one of man's oldest and most versatile materials of construction. The earliest uses antedate the dawn of recorded history. Many references to its use are found in biblical history, and archaeological discoveries have shown that the ancients were acquainted with the waterproofing and adhesive qualities of asphalt. Of course the material which they used was obtained from naturally occurring deposits, and recent oil discoveries in Sinai indicate that the asphalt was derived from petroleum.

Some of the often quoted uses are the embalming of mummies reputed to be over 7,000 years old and still in an excellent state of preservation; the cementing of eye-sockets and the like in the relics of ancient sculpture; as a cementing medium in the construction of the Tower of Babel; the waterproofing of the basket in which Moses was concealed in the bullrushes. It has also been recorded that Cleopatra used some sort of asphaltic product to enhance the charming angles of her eyebrows. But during most of the civilized period of man somehow the value of asphalt never became recognized. It is only in comparatively recent years that this universally valuable material was rediscovered.

There are records that indicate that along about 1800 the first "rock asphaltic mastic" sidewalks and bridge floors were constructed in Paris. This rock asphalt, still used in Europe today, is a naturally impregnated deposit of fine-grained limestone, the soluble bitumen being only about 9 or 10 per cent and of a very soft variety. It is undoubtedly a result of the metamorphosis of a petroleum saturated limestone formation. In about 1838 this same material was similarly exploited in the United States.

In 1854 in Paris, in 1869 in London and 1870 in Newark, this material was used in the construction of the first heated, compressed asphalt roadway. In 1879 there appeared the first synthetic sheet asphalt pavement in Washington, D. C., in which Trinidad asphalt was used. This Trinidad, a naturally occurring hard asphalt, is obtained from the well-known lake of asphalt on the Island of Trinidad off the coast of Venezuela, South America. It contains only 56 per cent bitumen (the remainder being non-asphaltic) and was softened with a medium heavy petroleum residuum called a "flux," and this combined with a selected grade of sand and finely divided filler. Fortunately, fluxed Trinidad asphalt is an excellent material for the type of construction in which it was used, so development was not hindered by failures due to improper asphaltic binders. Trinidad mixtures with sand and filler from then on supplanted almost entirely the imported rock asphalt.

In the late nineteenth century some of the natural deposits of asphalt in California were developed, these in the main being relatively pure bitumens.

Discovery in Distillation

About the same time, in distilling California oils to manufacture fluxes for Trinidad, it was found that by carrying the distillation further, a hard, brittle asphalt was formed. This, when fluxed with a lighter residual, was used to compete with Trinidad. Of course this led to the obvious discovery that by not carrying the distillation too far, an asphalt cement could be produced which did not require softening. In other words, it was refined to the proper grade or penetration in the still but with haphazard quality and uniformity until refinery technique advanced.

By 1902 the industry was consuming 21,000 tons annually of asphalt produced from domestic petroleum in addition to the importations from Trinidad. Coincident with the development of California asphalt, the processes for oxidizing, both by means of air-blowing and with sulphur, were developed using California, Mid-Continent and Ohio oils. As nearly as can be ascertained, the roofing industry, which previously has been using resins, wood-tars and coal-tar pitches, followed the paving industry; apparently there was no independent development.

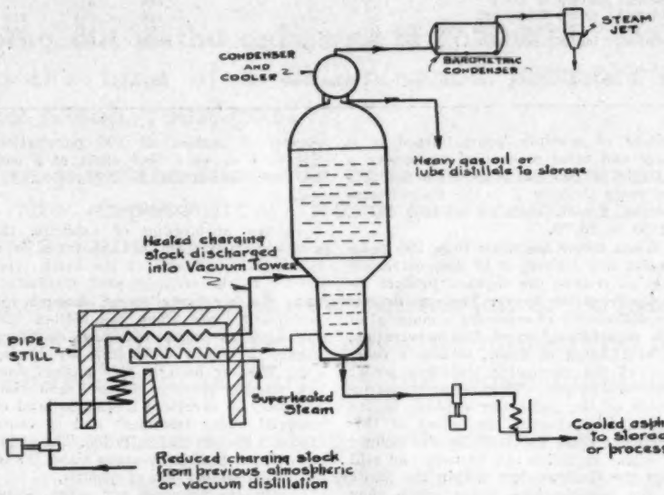

STEAM JET
CONDENSER AND COOLER
BAROMETRIC CONDENSER
Heavy gas oil or lube distillate to storage
Heated charging stock discharged into Vacuum Tower
PIPE STILL
Superheated Steam
Cooled asphalt to storage or process
Reduced charging stock from previous atmospheric or vacuum distillation

Figure 1—Continuous vacuum distillation unit for asphalt production

By 1912 the annual consumption had reached over 350,000 tons and now included Gulf Coast and Mid-Continent asphalts. Abou 1910 the Mexican oils were exploited and found to yield a high percentage of an asphalt base. The actual development began about 1913, and so stimulated paving uses that by 1917 the annual production in the United States reached 1,300,000 tons; this now represented 83 per cent of the total consumption. By the year 1930 (the latest figures available) this had increased to 3,500,000 tons, or 20,000,000 bbls.; 1931 and 1932 may very likely show a small decrease.

However, there is every reason to believe that the construction of bituminous roads will increase even more rapidly than in the past few years, impelled by the fact that these materials lend themselves most admirably to the construction of low-cost, all-weather, farm-to-market roads, as well as the building of pavements adequate to carry the world's heaviest and densest traffic. Strange as it may seem, over 75 per cent of our nation's roads are still totally unimproved; over 70 per cent of our farms are still served by dirt roads—impassable during parts of the year. Likewise, with anything approaching normal business conditions, roofing requirements, for both replacement and new construction should advance as well as the almost certain increases bound to occur from constantly growing new sources.

Refining Methods

As previously mentioned, the two processes for manufacturing asphalt are inherently different. The distillation process is for the most part purely a physical separation of the various hydrocarbon components which make up the residuum. The lighter and intermediate oils are distilled overhead, leaving the asphalt as the final residue; concurrently, depending upon the time, temperature and the particular distillation method and apparatus, there occurs, to a minor degree, chemical transformations of condensation and polymerization in which asphalt is synthesized. On the other hand, the air-blowing process is purely a chemical transformation brought about by the action of the oxygen of the air in contact with the heated residuum. The result of this chemical reaction is a condensation or aggregation of hydrocarbon molecules with the elimination of hydrogen (in the form of water) and probably some fixation of oxygen. Due to the use of comparatively low temperatures, there is only a slight loss by distillation and the yields therefor are much greater than in steam or vacuum refining, when compared with the same charging stocks.

Since the asphalt obtained by distillation is a solution of the asphaltenes in a much lower proportion of the oily constituents than that obtained by air-blowing, it is apparent that fundamental differences in the physical states should exist. It is also equally obvious that asphalts obtained by either process from petroleum of widely varying composition are quite different even when similar refining conditions exist. There is no need or reason, however, to characterize asphalts by the terms "paraffin," "semi-asphaltic," or "asphaltic" base, because there is too much overlapping of oils which have been designated rather loosely by these terms. Under proper refinery conditions and operation almost any asphalt-bearing residue, whether the source of the crude be predominantly paraffinic or predominantly asphaltic, can be separated, leaving a useful asphalt.

For some uses, particularly in some of the oxidized asphalts, the presence of the paraffinic constituents is necessary to produce the desired characteristics in the finished product; on the other hand there are uses in which only so-called "asphaltic" constituents may be present in the final asphalt. As an example of the differences resulting from the method of refining, Table 1 shows the products obtained from the same residuum using both processes in laboratory apparatus.

Distillation

The first distillation process was, of course, of the batch shell still type in which crude oils or topped residues were distilled to produce the heavier "fluxes" for softening the natural asphalts. It was found that by the use of steam injected into the still through perforated pipes placed along the bottom, better products could be obtained and that by carrying the distillation farther, asphalts of progressively increasing hardness resulted. The function of the steam is exactly the

same as its use in any other refinery steam distillation operation, that is, to lower the vaporizing temperature by reason of its partial pressure effect and also to cause mechanical agitation and sweeping out of vapors. Without steam, decomposition of the asphaltic molecules would occur before sufficient distillation had taken place, due to local overheating of stagnant oil films and maintenance of higher temperatures for too long a period, impairing the yield, quality and usefulness of the resulting asphalt.

The original shell stills were capable of producing extremely uniform and commercially desirable grades of asphalt, easily controlled as to consistency and quality, once the proper refinery technique for the various oils was developed. Batch still operations, however, are slow and expensive and to overcome this, continuous batteries of shell stills were employed and shell vacuum stills were also tried but never came into very widespread use.

The rather recent development of pipe or tube stills for attaining either distillation or cracking temperatures and the separation of the products of vaporizable constituents from the nonvolatile residues by means of fractionating columns, vaporizing drums or flash towers has been of great value in the manufacture of asphalt. The first use of vaporizing towers in conjunction with pipe stills did not employ reduced pressure, but separation was accomplished by surrounding the towers with brick shells leaving an air space through which hot gasses were circulated, and also by injecting steam into the base of the tower to assist in vaporizing. Then followed the use of vacuum towers with and without the supplemental use of steam. Here separation takes place by the reduction of pressure, and does not require the maintenance of temperatures as high as if normal atmospheric pressure is used.

When steam is used (wet vacuum), the vacuum towers operate on an average of about 25 to 50 mm. absolute pressure, but if steam is omitted (dry vacuum), much lower vacuum would be necessary to obtain the same results; the presence of steam, by its partial pressure effect, lowers the effective pressure which the oil must overcome in changing to the vapor phase.

"Flash-Vacuum-Coil" System

The "flash-vacuum-coil" system of refining asphalt is capable of producing material equally as uniform and satisfactory as the best of the shell still operations. In addition, because of the greater rate of heat transfer by reason of high velocity and turbulence, it has permitted the use of higher temperatures. This in turn permits asphalt bearing crudes, formerly unsuitable for shell still manipulation on account of the extremely high boiling points of the intermediate fractions, to be processed. With special attention devoted to the arrangement of the heating tubes in the convection and radiant sections of the furnace, the rate of temperature rise and the time of maximum temperature subjection, or "soaking," can be accurately and carefully controlled, and the effects of cracking or coke formation can be eliminated even when approaching the higher temperatures.

The period of maximum temperature in a pipe still is a matter of seconds only, whereas in shell stills it is hours. The shell stills employ temperatures of about 600° to 700° F. for periods of 12 to 24 hours per batch of 400 to 500 bbls. maximum; pipe still installation, using a temperature of 750° F. and sometimes higher, and handling 5,000 bbls. per day, are now in use.

In the flash-vacuum-coil system of operation the consistency of the asphalt taken out of the tower is controlled by the temperature, the amount of steam and the degree of vacuum used. Higher temperatures, more steam and lower vacuum all mean a great amount of vaporization in the tower, leaving a heavier or harder residue. Proper correlation of these factors permits the continuous production of uniform asphalts as hard as 20/40 penetration, but this necessitates the use of the maximum temperature and the lowest vacuum with the attendant danger of possible injury, hence it is safer and more economical to remove a material of 100/150 penetration and subsequently air-blow it to the desired commercial grades, such as 85/100, 60/70, 50/60 or 40/50.

When softer materials than 100 penetration are desired, it is then extremely easy to remove the finished product directly from the tower. The question of the desirability of removing a material of 100 penetration, or of 150 penetration, or of running to grade, is also a function of the particular materials under process. The controlling factor is the reaction of the particular asphalt to the oxidation treatment, the extent of this treatment being regulated by the amount of oxidation which can be used and still keep the final product within the limits of the specifications under which they are sold; some materials may fail to meet a specification if oxidation is started at, say, 150 penetration, but would comply if started at 100 penetration. Figure 1 shows a flow chart of a continuous vacuum-flash-coil operation.

TABLE 1

	Residuum used	Steam refined	Air-blown
Specific gravity at 77° F., A.P.I.	10.5	1.047	1.017
Flash, Cleveland open cup, ° F.	410	570	480
Solubility in CS_2, per cent	99.9	99.9	99.9
Solubility in CCl_4	99.9	99.8	99.8
Penetration at 77° F., 100/5	....	55	56
Penetration at 32° F., 200/60	....	18	31
Penetration at 115° F., 50/5	....	260	128
Ductility at 77° F., 5/60, cm.	....	100+	4.0
Cementing value at 41° F., kgmm.	....	0.15	0.07
Elongation at 41° F., cm.	....	9.0	3.5
Softening point, R&B, ° F.	....	128	157
Yield, per cent	....	65	96

TABLE 2—ROOFING ASPHALTS

	(1)	(2)	(3)
Penetration at 77° F., 100/5	16	20	24
Penetration at 32° F., 200/60	10	14	15
Penetration at 115° F., 50/5	29	36	44
Ductility at 77° F., 5/60, cm.	4	3	....
Specific gravity at 77° F.	....	1.03	1.01
Softening point, R&B, °F.	228	225	190
Flashpoint, Cleveland open cup, °F.	....	500	610
Solubility in CS_2, per cent	....	99.7	99.7

Source of residuum:
(1) Columbian and Mexican. (2) Gulf Coast and Mexican. (3) Mid-Continent pipe still residuum.

BRICK FILLERS

	(1)	(2)	(3)
Penetration at 77° F., 100/5	38	52	50
Penetration at 32° F., 200/60	25	30	26
Penetration at 115° F., 50/5	70	119	96
Ductility at 77° F., 5/60, cm.	4.5	4.0	46.0
Specific gravity at 77° F.	1.005	1.018	....
Softening point, R&B, °F.	178	160	172
Flashpoint, Cleveland open cup, °F.	495	450	415
Solubility in CS_2, per cent	99.8	99.9	99.7

Source of residuum:
(1) Gulf. (2) Mexican. (3) Mid-Continent and West Texas.

SEALING AND COATING

	(1)	(2)	(3)
Penetration at 77° F., 100/5	75	16	40
Penetration at 32° F., 200/60	50	12	37
Penetration at 115° F., 50/5	131	19	58
Ductility at 77° F., 5/60, cm.	3.0	1.0	1.0
Specific gravity at 77° F.	.980	1.044	....
Softening point, R&B, °F.	185	265	218
Flashpoint, Cleveland open cup, °F.	510	495	525
Solubility in CS_2, per cent	99.9	99.6	99.8

Source of residuum:
(1) Mid-Continent. (2) Mexican. (3) Smackover.

Oxidation

In the air-blowing of asphalts, the most common form of apparatus is a cylindrical shell still of the batch type, similar to the ordinary shell distillation unit, the air being forced through the perforated pipes along the bottom just the same as steam in steam distilling. Figure 2 shows a typical air-blowing unit. The air used in this method does not require pressure higher than that necessary to overcome the static head of material under treatment and to cause intimate contact and agitation. The quantity of air usually averages about 20 to 30 cubic feet per ton of asphalt.

Continuous processes and other means of contacting with air are gradually being developed, but the economic considerations are not as important as they were in the development of continuous distillation operations. The ordinary charging stocks may be anything from semi-liquid residues to semisolid asphalts, the extent of the antecedent distillation processes depending upon the characteristics desired in the finished asphalt. Crudes or unrefined oils or residues not previously distilled to remove all of the naphtha, kerosene and sufficient gas oil to bring the flashpoint over about 400° F., are never used. As a general rule the charging stocks are straightrun residual products; most of the highly cracked residues from pressure cracking stills are, for the most part, not amenable to air-blowing in the same sense that straightrun materials are. Usually even though comparatively low temperatures are used, the air causes distillation rather than oxidation.

The temperatures for air-blowing ordinarily range from about 425° to 500° F., and since the reaction is of the exothermic type, very little external heat is necessary after operating conditions are once reached. The time required is a matter of a few hours to 24 hours or longer for very high melting point and low penetration products. The continued agitation with air gradually forms asphalts of progressively increasing hardness and melting point. For any given conditions, blown asphalts as compared with steam or vacuum refined asphalts are always less susceptible to changes in consistency between high and low temperatures, have a higher softening point for a given penetration, and have much lower ductility values. Typical air-blown asphalts from various sources and for various uses are shown in Table No. 2.

As a general rule it might be said that air-blown asphalts are less adhesive than steam or vacuum refined products, and that when asphalts are to be used for binding mediums, such as to cement together the particles of mineral aggregates in paving mixtures, the steam or vacuum refined products are used; when they are to serve as coating or covering mediums for roofing, insulation or waterproofing, then the less susceptible blown asphalts are used. Paving asphalts, with the exception of fillers for block and brick pavements, are only slightly air-blown, if at all. Roofing asphalts, especially the coating material for composition roll roofing and shingles, are always blown.

Cracking

The use of residues from gasoline cracking processes for the production of asphalt is not new. Certain types of asphalts, particularly some of those used in waterproofing and asphalt paper manufacture, having a low softening point for a given hardness, can best be made from certain varieties of pressure still residues. Some paving grades have been made of blends of straightrun and cracked residues for some years and have apparently been satisfactory. To replace all grades of straightrun asphalts with all the varieties of cracked materials, as has been often proposed, is highly impossible. In the first place there is a vast difference between pressure still residues, since they may be derived from every conceivable grade and variety of charging stock and are produced by a large number of processes operating under widely differing conditions of temperatures, time periods and pressures. It is impossible to speak in the same breath of such purely synthetic products as asphalt obtained from the cracking of paraffinic naphtha and asphalt obtained from cracking a heavy Mexican residual oil. Furthermore, some processes subject only a part of the residuum to cracking temperatures for only a short interval, while some maintain all of the residue at high temperatures for varying lengths of time.

Generally speaking, at the present state of the industry, it appears that cracked asphalts may find a useful field either alone or blended with other materials, in most of the uses other than for hot-mix types of pavements. Undoubtedly improvements in the cracking operations, when special attention is directed to the quality and character of the residuum produced, may develop processes which will equal the quality of the asphalt which it is now possible to produce from straightrun residuals. It is likewise not improbable

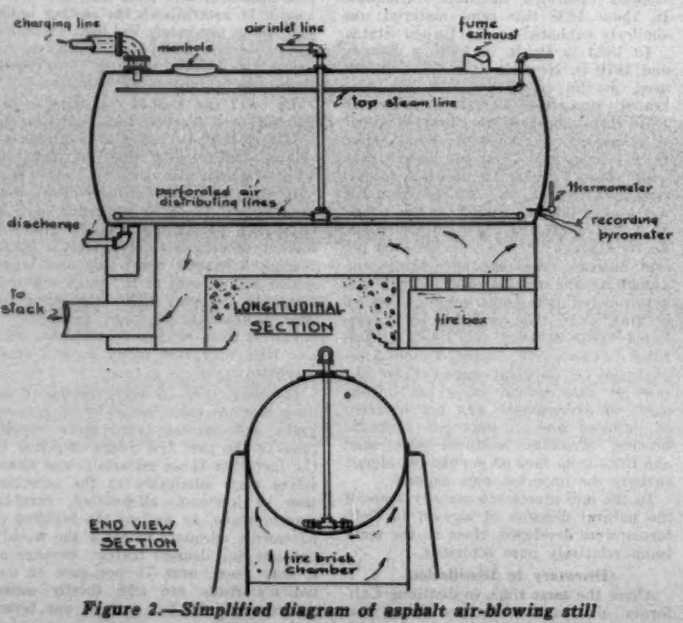


Figure 2.—Simplified diagram of asphalt air-blowing still

Stripped for Action

Refinery operations are limping, working forces are way down, payrolls are at rock bottom—all costs have been cut to the bone.

These are negative conditions, forced by harsh necessity. Negative conditions never bring prosperity.

But dead wood has been trimmed out—fat has been sweated off—organizations are stripped for action.

Stepping out is the only way to go ahead. Stepping out to the tune of a well-planned program is the way to reach your goal.

We can play the tune for your forward march. We have the experience, the organization, the plant facilities—and the will.

We know how to build new refineries or revamp old ones—to build, remodel or relocate marketing plants. We regard both as parts of the same machine.

We can organize operating methods for the refining-marketing machine that will show new economies and better earnings for you.

Are you interested?

We are ready.

Write, telegraph—or call us up.

LEADER INDUSTRIES, INC.

RESEARCH «» ENGINEERING «» MANUFACTURING
FINANCE «» CONSTRUCTION «» OPERATION

DECATUR, ILLINOIS «» «» «» U. S. A.

that present-day products may even be excelled. There is also a certain stigma attached to the use of cracked asphalts due to some failures which may have resulted from injudicious uses rather than from the inferiority of the product, and this must be overcome.

It would appear that since the quality of cracked residues is being steadily improved with reference to their suitability in producing asphalts, it is within the range of possibility to manufacture from them cut-backs and emulsions which have highly desirable properties not found in straightrun materials, and thus overcome this prejudice.

Almost invariably asphaltic materials when used are brought to a fluid or semi-fluid state, this condition being attained either by using when treated, or if cold, by having previously liquefied the asphalt by "cutting back" with diluents such as naphtha, kerosene or light gas oil, or by emulsification with water. In paving and road building there seem to be some uses for almost every conceivable grade, but by far the largest amounts are divided between three uses.

Asphalt Cements

The first, though not the largest in volume but nevertheless the highest in quality, is that of the hot-mixed type pavements known as sheet asphalt and asphaltic concrete of various forms. In these structures the heated mineral aggregate (sand in the case of sheet asphalt, and sand and stone in asphaltic concrete), carefully controlled as to quality and particle sizes, a finely pulverized mineral powder, and a hot asphalt (ranging from about 5 to 10 per cent by weight of the total mixture), are combined by mixing, transported while hot, spread on the previously prepared foundation and compressed by rolling while still hot.

The asphalt cement used in this type of construction is always of the vacuum or steam refined variety in which air-blowing may have been used in the last stages of refining to reduce susceptibility to temperature changes. Cut-back asphalts or emulsions are never used in this type of construction, but they are used in proprietary and patented mixtures for producing cold laid pavements of similar characteristics. The grades of asphalt almost always used are designated by their penetrations at 77° F., and are marketed as 40-50, 50-60 and 60-70, these 10-point ranges being allowed for testing and refinery control limitations.

Occasionally extreme and severe traffic conditions may require a material harder than 40 penetration, but the softer grades are preferable for general uses, and it is rapidly becoming more generally known that even softer grades may be used with no disadvantages but rather with improved results over a period of time. Typical analyses of asphalt cements suitable for hot-mix work are shown in Table No. 3.

It might be well to state that the penetration test is a determination of hardness and is obtained by measuring in tenths of millimeters the depth to which a sharp-pointed standard needle penetrates when allowed to act under a specified weight at a specified temperature, for a given time. The ordinary test is 100 grams for five seconds, at 77° F. Ductility is a measure of the length in centimeters to which a briquette of the asphalt 1 centimeter in cross-section will elongate or stretch when pulled apart at standard rates of speed and at specified temperatures. The ordinary test is a rate of 5 centimeters in one minute, at 77° F. Together these tests are the main control factors used in regulating the refining process for making paving asphalts; other valuable tests are used in judging quality, in evaluating new sources of materials, new methods of manipulation and also in controlling the uniformity of supply if blends of residues are used as the starting stock.

The second use is in the type of construction known as asphaltic or penetration macadam. Here a layer of crushed stone is spread and rolled in place, and then asphalt cement of 85/100 penetration, or 100/120 penetration, usually steam or vacuum refined only, is applied hot by means of pressure distributors and allowed to penetrate the interstices and coat the exposed surfaces of the stone. Smaller stone is then applied and rolled to key together the larger aggregate, more of the same hot asphalt again applied, and then a surface application of chips is applied. Here also may be used emulsified asphalts which, since they are fluid at atmospheric temperatures, are applied cold. Table No. 4 shows the analyses of some typical asphalts used in this work.

TABLE 3—TYPICAL ANALYSES OF ASPHALTS USED IN HOT-MIX WORK

	(1)	(2)	(3)	(4)	(5)
Penetration at 77° F., 100/5	45	52	45	54	50
Penetration at 32° F., 200/60	14	14	13	11	16
Penetration at 115° F., 50/5	313	290	240	350+	225
Ductility at 77° F., 5/60, cms.	150+	150+	150+	150+	150+
Ductility at 41° F., 1/60, cm.	....	6.5	....	....	....
Ductility at 32° F., 1/4-60, cm.	5.75	8.25	....	14.5	10 5
Specific gravity at 77° F.	1.012	1.020	1.020	1.020	1.040
Softening point, R&B, °F.	130	129	129	134	135
Flashpoint, Cleveland open cup, °F.	600	660	680	665	630
Cementing value at 41° F., kgm.	.155	.180	.22	.38	.180
Elongation at 41° F., cm.	5.75	6 0	4.5	15 0	11.5
Loss 5 hours at 325° F., 50 grams, per cent.	0.04	0.02	0.04	0.02	0.02
Penetration after loss	44	45	42	52	45
Per cent loss in penetration	2.2	13.5	6.7	4.0	10 0
Fixed carbon, per cent	....	16.1	15.9	11.0	16 3
Solubility in CS_2, per cent	99.9	99 7	99.8	99 9	99.9
Solubility in CCl_4, per cent	99.8	99.7	99.8	99.9	99.9
Soluble in 86° naphtha (hexane), per cent	77.8	78.7	78.5	89.8	71.2

Source of residuum, and process used:
(1) Mid-Continent pipe still and vacuum tower—some oxidation.
(2) Smackover pipe still and vacuum tower—some oxidation.
(3) West Texas and Mid-Continent, steam, batch still—laboratory.
(4) California, batch, steam—no oxidation.
(5) Mexican, steam, continuous—no oxidation.

TABLE 4—ANALYSES OF TYPICAL ASPHALTS USED IN PENETRATION TYPE CONSTRUCTION

	(1)	(2)	(3)	(4)
Penetration at 77° F., 100/5	93	89	90	89
Penetration at 32° F., 200/60	15	29	23	31
Ductility at 77° F., 5/60, cm.	150+	150+	150+	150+
Ductility at 32° F., 1/60, cm.	....	12.0	....	....
Ductility at 41° F., 5/60, cm.	....	12 5	....	....
Specific gravity at 77° F.	1.017	1.041	1.027	1.016
Softening point, R&B, °F.	112	118	118	117
Flashpoint, Cleveland open cup, °F.	585	520	585	490
Cementing value at 41° F., kgmm.	0.16	0.04	0 09	0.06
Elongation at 41° F., cm.	20+	17+	12+	6 5
Solubility in CS_2, per cent	99.9	99.9	99.9	99.9
Solubility in CCl_4, per cent	99.9	99.9	99 9	99.9
Solubility in 86° naphtha (hexane), per cent	....	72.5	77.2	78.2

Source of residuum:
(1) California. (2) Mexican. (3) Wyoming. (4) Mid-Continent.

The third type of use is in the various methods of building secondary roads, or surfacing lighter traveled highways, or as the first increment of development known as "stage construction." These methods include such terms as "road mix," "mixed in place," "retread," "oil mix" and "plant mix." There is much confusion between the terms used and often the same term has different meanings in different sections of the country. The best terminology is to divide the methods into two classes, in which the terms are related to the thickness of the compacted surfaces. Under this differentiation it has been proposed to call treatments resulting in wearing courses of over 1 inch in thickness, "road mix surfaces"; all of those less than 1 inch, "surface treatment." The asphaltic materials include cutbacks of every type, emulsions of all the varieties and residuals of all descriptions from heavy oils to asphalts.

Cutbacks

In addition to the asphalt cements previously described there is a considerable quantity of preliquefied asphaltic products used in road construction. These are cutbacks and emulsions and are composed of heavy residual oils or asphalts, liquid at normal or somewhat above atmospheric temperatures, but which revert to their original base consistency after exposure in thin films. The cutbacks are manufactured products in which fluidity is obtained by dilution or fluxing, rather than by heating. Their use permits application to the road or mineral aggregate surfaces without the necessity of heating the aggregate and allows a longer time during which manipulation can take place, than if hot asphalt cement were used.

Cutbacks are made for many purposes among which are primers, seal coats, carpet coats, and road and plant mixes in which the aggregates may be open graded or dense graded and with or without sand or 200-mesh filler. Consequently there must be a number of varieties, both as to original viscosity, consistency of base after evaporation and rapidity of volatilization of the diluent. The diluents are usually naphthas, kerosenes or light gas oils, which need not be refined to any rigid standards of color or odor or extremely narrow range of boiling points, since the function of the diluent is temporary and it eventually disappears.

There has been a multiplicity of specifications and overlapping of grades for various uses, but recently the large consumers and producers have been attempting to standardize the products required, and specifications have been drawn as the result of tentative agreements. The types are divided into three groups known as "rapid," "medium" and "slow" curing, the prime differences being in the volatility of the distillate used for cutting back. Within each of the groups the viscosity is controlled by the percentage of diluent which is added; the viscosity of the finished product may range from a limpid fluid, such as water, to a very heavy consistency which requires warming before application.

Cutbacks are also used in other industries for waterproofing, roofing, paints and japans, fibrous cements and coatings, etc. The asphalt cement bases for these uses are usually harder than the highway materials and frequently include blown asphalts.

Emulsions

The manufacture of asphaltic emulsions for paving uses originated as early as 1905 but it is only within the last few years that they have become an important part of the industry. This reawakening was instituted with the commercial development of paving emulsions in which the rate of break could be controlled. Commercial development and perfection of emulsions for industrial purposes began about 10 years ago, and has progressed rapidly in such uses as waterproofing, paints and coatings, in paper and board manufacture, and insulating and soundproofing.

The two types of emulsions are quite different, as are the method of manufacture and the materials used. The road emulsions are normally of the soap type and the asphalt used is usually softer than 100 penetration; the industrial type of emulsions use inorganic mineral powders such as colloidal clays for the emulsifying agents, and steam refined asphalts of relatively hard penetration.

The apparatus used in the road type is usually a form of colloid mill, an adaptation of the mill principle, or batch agitators, while the industrial emulsions require specially designed emulsifiers. Both kinds of emulsions are of the water external phase type, which means that they are further dilutable with water and are nonadhesive until the water is expelled or the emulsion breaks. The asphalt external type of emulsion is, of course, possible but it is never used since it would be viscous and adhesive.

All asphalt emulsions are compositions in which fluidity at atmospheric temperature is obtained by dispersing the asphalt in water in the form of very finely divided, microscopic size particles; neither the use of heat nor diluents is necessary. The dispersed asphalt particles are prevented from coalescing (until desired) by means of a stabilizer or protective colloid called the "emulsifying agent." The protective colloid, by reason of its ability to concentrate at the interface of the oil globules and lower the surface tension, forms a protective film around each particle and thus prevents contact between these particles.

Other Emulsifying Agents

In addition to the soaps and colloidal clays, a vast number of other emulsifying agents are used, both organic and inorganic as well as combinations of agents for certain purposes, such as to control the sensitiveness to electrolytes and to permit mixing with fillers or fine mineral particles. Some emulsions are made without adding a protective colloid, by taking advantage of the fact that certain asphalts contain sufficient naphthenic acids or other saponifiable constituents to form a soap in situ upon the addition of an alkali to the water. The rate of breaking of the road emulsions is usually a function of the amount of protective colloid present, the slow-breaking containing the higher percentage of soap.

The manufacture of emulsions, while not exceedingly intricate, is still not relatively simple and, therefore, each producer very carefully guards as trade secrets the amount and type of emulsifying agent used. There are numerous patents covering both the materials and the method and apparatus used, and undoubtedly many applications are pending.

Emulsions in road construction are classed under four types, "quick-breaking," "medium-breaking," "slow-breaking" and "mixing." This refers solely to their reactions when applied to or mixed with mineral aggregates and when spread in thin films; under ordinary conditions of shipment and storage, they are all stable, and are likewise able to withstand freezing when suitably treated. They are particularly adapted to a wide range of usefulness and are satisfactory for use in almost all the types of bituminous road construction. In low-cost road construction they are eminently suitable for use in moist climates or during wet weather because they can be applied to moist or damp aggregates.

The commercial road emulsion normally contains 55 to 75 per cent asphalt, one-half of 1 per cent to 3 per cent emulsifying agents and the remainder is water. They range in fluidity from the viscosity of water to that of thick molasses as the asphalt percentage increases. The asphalts used may be from all of the known sources, but their successful use depends upon skillful modification of the methods, apparatus and emulsifying agents used. The process used in refining the asphalt sometimes calls for special considerations in the emulsion manufacture.

RUSSIA'S NEW OIL FIELD

A special Russian government commission headed by the chairman of the Turkman Soviet Socialist Republic visited Neftedag, Turkmenia, across the Caspian Sea from Baku, where a gusher, which recently flowed from well No. 13, continues to flow with unabated force. During three days the gusher increased its original yield to 11,000 to 12,000 tons a day. The height of the jet reached 70 to 80 meters (229 to 262 feet). As Neftedag possessed only one electric pump it was necessary to transfer three more pumps to cope with the flow. This was inadequate, and a new railway siding was constructed to fill 200 cars a day. The commission has arranged for the construction of a 10-inch pipe line to the siding. Later the well decreased in force, yielding about 500 tons a day, and reaching a height of only 8 to 10 meters.

Belgian Government Fostering Development of Refining Industry to Meet Nation's Needs

In an attempt to develop a domestic oil refining industry, the Belgian government has enacted tariff and excise regulations, granting to the home industry substantial protection for products manufactured within the country.

It will be remembered that the French government recently passed definite legislation requiring all importing and selling agencies of petroleum products to take immediate steps to build refining capacity within the country for the major part of their sales. France is thus assured of establishment of a national refining industry before the end of 1933, this by direct, positive legislation.

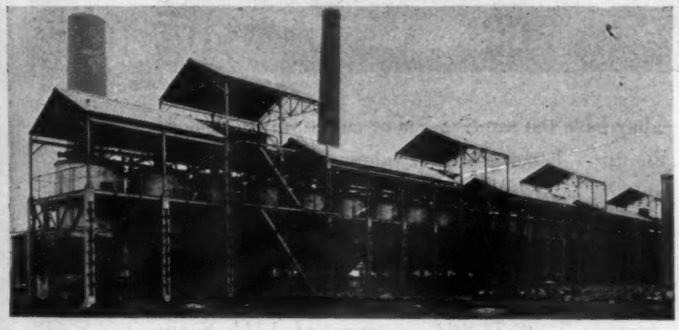
Belgium's approach to the same end has perhaps been less speedy in achieving results, but is more logical and more economically sound. That is to say, she has made the business attractive by protective legislation, knowing that interested parties eventually of their own volition will invest the necessary capital to build up the industry to the desired point.

There are two reasons for this. One is that above all, Belgium is a manufacturing country, a country to which raw materials such as cotton, iron, etc., are transported for manufacture into finished materials. Therefore, it is essential that petroleum, being one of the great industries of the day, be also represented. Secondly, the importance of petroleum products in the conduct of modern warfare cannot be overestimated, and it is realized that the possession of an adequate refining industry is a tremendously important unit in a well integrated system of national defense.

TABLE 1—REFINERIES IN BELGIUM

Name—	Capacity, bbls. per day	Products
Belgian Cracking Co.	300	Gasoline; Diesel oil; coke; fuel oil.
Belgo Petroleum Co.	1,200	Gasoline; kerosene; Diesel oil; fuel oil.
Companie Gaz Catylitic	100	Gasoline; asphalt; alcohols; gas.
Petroleum Products Refining Co.	...	Vaseline; lanoline.
Purfina	400	Lubricating oils; medicinal oils; special oils and greases.

Battery of Sittling Type Treating Drums



Battery of treating drums at the refinery of Purfina at Ertvelde, Belgium

Tariff Advantages Accorded

The tariff advantages that have been accorded the industry to make it interesting are by no means small. The following tabulation shows this extent.

PROTECTIVE TARIFFS PLACED ON OIL PRODUCTS
(American dollars)

	Import duty, cents/gal.	Excise tax, cents/gal.	Protection, cents/gal.
Gasoline	14.5	10.0	4.5
Kerosene	11.9	8.5	3.4
Gas oil	.9	0.0	.9
Fuel oil	.9	0.0	.9

It may thus be easily seen that with local sales prices established by the cost of the imported products, refining in Belgium offers very interesting possibilities.

Two of these refineries, though not large, are unique.

The Belgian Cracking Co. was created by the Centrales Electriques des Flandres et du Brabant in 1928. The Centrales Electriques is a large electric power company situated in the suburbs of Ghent. It is a large consumer of coal and for a long time has been studying the rational utilization of this product. To this end a cycle has been created in which coal first is passed through a low temperature carbonization plant. The coke is used for firing the boilers of the power plant, and the tar is passed on to the Belgian cracking Co. for processing.

This tar is first distilled in simple distillation by a Borman pipe still where three products are made: light gasoline, 300° endpoint; "heavy gasoline," 420° endpoint, and residue. The heavy gasoline contains phenols and is difficult to treat chemically, but work carried on indicates that this product may be successfully hydrogenated.

The residue from the first distillation is passed on to a specially built Dubbs cracking still. This still differs from the Standard Dubbs units in that it is built for an operating pressure of 30 atmospheres instead of 10-15 atmospheres. Also the unit as a whole is smaller, having a throughput capacity of 300 bbls. per day.

Including the yield of gasoline obtained by drying the gases from the initial carbonization and the light gasoline mentioned above, a yield of 50 per cent gasoline has been obtained by this process from the coal tar. The cracked gasoline is acid treated and rerun as is common practice with cracked distillate from petroleum residue.

The Belgian Cracking Co. also runs petroleum crude oil and residue, varying the operation between this and coal tar as the market conditions demand. When thus operating, oils from Rumanian sources are generally used.

This company as mentioned above has done considerable work on hydrogenation, having in mind hydrogenating the heavy gasoline from the first distillation, and the coke from the cracking distillation; thus completing the coal cycle.

The Compagnie Belge du Gaz Catalytique, Brussels, is one of the pioneers in vapor-phase cracking, having started commercial operations with its process in January, 1924.

Either gas oil or fuel oil is used as a charging stock and is cracked in vapor phase, using a special catalyst. The residue remaining from the operation is a commercial grade of asphalt and is used for treating roads.

The cracked gases are rich in unsaturated compounds, such as propylene and its homologues, and in 1926 this company began the manufacture of iso-propyl, butyl and amyl alcohol. At the present time these alcohols are being produced in the following quantities:

Iso-propyl, 30,000 liters per month.
Butyl, 5,000 liters per month.
Amyl, 1,000 liters per month.

The stripped gas from the alcohol plant is used for blending with and enriching artificial gas for lighting purposes.

Treating of the cracked gasoline is accomplished in the vapor phase by the Gray process.

The company is enlarging its installations by the addition of a topping still, permitting the direct importation of crude oil instead of the heavier products. Topping will be followed by the usual cracking operation.

Additional equipment is also being added for the recovery of the ethylene from the rich gas in the form of glycols and compounds of chlorine.

The Belgo Petroleum at Terdonck, near Ghent, from the standpoint of throughput capacity is the largest Belgian refinery The installation includes a Jenkins cracking still, a re-run still (1,000 bbls. per day capacity) and the usual attendant accessories, such as boiler plant, pump house, treating equipment, etc. Both acid treating and "doctor" treating are accomplished by the batch system, contact being made by recirculation with centrifugal pumps.

The refinery has a capacity of 1,200 bbls. per day running on skimming and cracking operation, or double this amount on straight skimming operations. Crude oil from the East Texas Field is used as raw material, and the following products are made: Gasoline, 375° endpoint; kerosene, 41° Be.; Diesel oil (all grades) and fuel oil.

The Purfina Ertvelde, near Ghent, is a refinery in true sense of the word as it is understood in Europe. That is to say, this factory does no distilling but imports the raw lubricating oil fractions, and by acid treatment and decolorization with special clays manufactures a complete line of fully refined oils.

The line of oils produced includes: Medicinal oils, white technical oils, turbine oil, transformer oil and all grades of automobile and industrial oils, greases, etc. Twenty thousand tons per year, or about 400 bbls. per day, of the above oils can be produced in this factory.

The Petroleum Products Refining Co., Antwerp, specializes in the manufacture of all grades of pharmaceutical and industrial vaselines. The installations have been recently perfected and enlarged to permit the fabrication of "Lanoline," a product coming from the purification and refining of wool fat.

It is interesting to note that of the above five refineries, three are located in the industrial suburbs of Ghent, and on the deep sea canal from Ghent to Terneuzen (Holland). This canal is one of the few inland canals in the world permitting the passage of seagoing ships up to 10,000 tons.

Try to Maintain Retail Prices

The larger miporters, mostly subsidiary companies of international oil groups have for many years attempted to maintain retail prices by a sort of cartel agreement. Each of the companies in the understanding sells only a certain agreed upon quota of the market. The following table gives an idea of the gasoline sold by the larger importing oil companies:

	Per cent
Shell (approx.)	30
American Petroleum Co.	24
British Petroleum Co.	13
The Texas Company	12.5
Purfina	9.5
Sinclair	6.5
Atlantic	2.5
Deco	2
Total	100

Service stations as conducted in the United States are unknown. In Belgium, even filling stations are rare, there being perhaps not more than a dozen in the whole country.

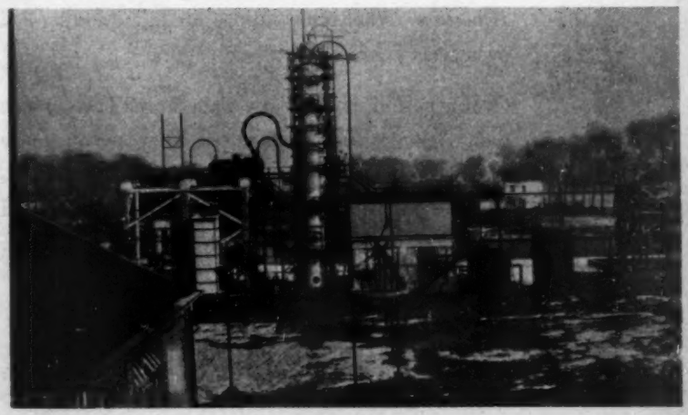
TABLE 2—PETROLEUM PRODUCTS IMPORTED INTO BELGIUM
(Quantities in barrels)

	Gasoline	Kerosene	Fuel oil and gas oil
1929	1,680,000	444,000	632,000
1930	1,940,000	600,000	810,000
1931	2,150,000	775,000	1,390,000
1932	2,750,000	630,000	760,000

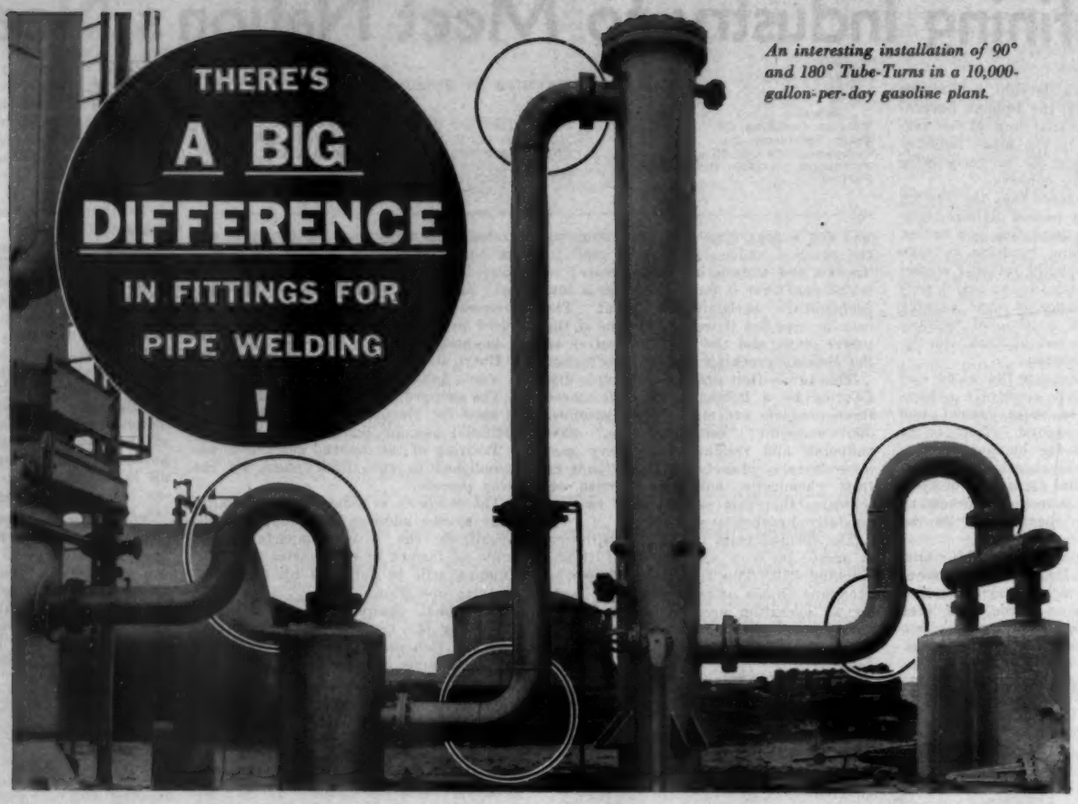
Note: Figures 1929-1930-1931 are from Government statistics. The 1932 figures are preliminary estimate.

Practically all the gasoline is sold from curb pumps placed mostly at garages, but sometimes at cafes, drug stores, etc. Air is generally not "free air" unless taken at the garage where one keeps his car.

Operate Modern Topping Unit In Belgium



General view of 1,200-barrel refinery of the Belgo Petroleum Co. at Terdonck, Belgium



An interesting installation of 90° and 180° Tube-Turns in a 10,000-gallon-per-day gasoline plant.

ASIDE from engineering differences such as smooth inner walls, uniformity of wall-thickness, etc., one of the greatest dissimilarities between Tube-Turns and other fittings is *this:*

Tube-Turns are the ONLY stock fittings for pipe welding that have *proven* their ability to stand up under severe conditions over long periods of time.

The installation above, for instance, was put in by a comparatively "new" customer—yet this purchaser says that during their two years' use, Tube-Turns have given them *"entire satisfaction"*.

(Question: What other fittings for pipe-welding had even been heard of, two years ago?)

Over a period of six years, Tube-Turns have *proven* their right to your confidence. They are the *only* fittings forged from seamless tubing, without thickening of inside walls, thinning of outside walls, and without the stresses induced by bending operations.

They have the same radius of curvature throughout the turn—hence greater freedom of flow. *They have uniform wall-thickness at ALL points**. . . . And there are still *other* differences that bring about worth-while differences in both life and performance. *Write* for all the facts. No obligation, of course. *Address:* TUBE-TURNS, *Incorporated,* 1311 South Shelby Street, Louisville, Kentucky.

TUBE-TURNS

***UNIFORM WALL-THICKNESS is *essential* in obtaining:** (1) **Satisfactory Joints.** Regardless of the workmanship or materials used, no welder can consistently make good joints unless the fitting lines up with the pipe—*in O. D., I. D., and wall thickness at the weld.* . . . Thickened walls also increase time and cost of welding.

(2) **Full-Life Piping.** Corrosion and erosion are always most severe at *the back* (outside) *wall* of a fitting. Thinning at this point *reduces life.*

* Tube-Turns have *uniform wall-thickness*—ALWAYS within A. S. T. M. tolerances *at all points.* No thinning of outside walls. No thickening of inside walls.

Refining of Playa Del Rey Crude Oil Presents Unusual Problems Due to Sulphur Content

By O. C. SMITH and H. H. SPANGLER
Western Oil & Refining Co.

Ever since the first production of petroleum in Pennsylvania, there have been pools of high sulphur petroleum discovered in various sections of the United States. The sulphur in these crudes is apparently present in different chemical combination, necessitating different treatments and methods of handling. Probably the most notorious of these high sulphur crudes is that obtained in the Texas Panhandle. In this crude, the sulphur appears mainly in the form of hydrogen sulphide, which leaves the oil in storage, and does great damage to storage tanks, and, in some instances, has taken human life. Also, the sulphur which remains in the crude is unstable and turns to hydrogen sulphide during distillation. This form of sulphur can be taken care of by treatment with any of a number of various alkalies or by water washing, with little additional expense.

The petroleum produced in the Playa Del Rey or Venice Field of California is extremely high in sulphur, probably the highest of any light refining crude in this country—approximately 2.25 per cent—and presents an entirely different problem in removal, as there is practically no hydrogen sulphide present in the crude oil and very little formed during distillation. The sulphur appears to distill over uncharged, consequently all of the products produced, from gasoline down to fuel oil, have a very high sulphur content, which increases in percentage in proportion to the gravity of the product.

When the first well of the Playa Del Rey or Venice Field came on production, the Western Oil & Refining Co. purchased approximately 2,000 bbls. per day of this crude over a period of two months. This was run through the refinery along with Signal Hill crude. During the entire time this crude was run to the stills, difficulty was encountered in treating the gasoline. This gasoline apparently did not liberate the water as freely as the straight Signal Hill gasoline, when washing after acid treatment. The gasoline also had a slight pink cast. It was found that the sulphur content of the finished gasoline increased from .04 to .08 per cent. The sulphur on the fuel oils also increased in proportion. With the prospect of having still more Venice crude to run in the future, it was obvious that, with our present treating methods, the sulphur content of the gasoline and fuel oil would be much higher than specifications permitted, which are one-tenth of 1 per cent on gasoline and 1.25 per cent on fuel oil.

Although the United States Government has no sulphur specifications for bunker "C" fuel oil, it is difficult to sell this grade of oil having a sulphur content over 1.25 per cent, so it was considered very essential that some method for reducing this sulphur be found if any quantity of this crude was to be refined.

Method of Investigation

It was decided that the most desirable way to reduce the sulphur content of the various products would be to remove it from the crude oil before, or during, distillation, and the following data shows the work done along this line in this refinery. The equipment used in this investigation consisted of a 2-gallon iron still for the aluminum chloride distillation, and the copper flask used in four-point control tests was used for the remaining distillations. No steam was used in any of the distillations. A 500 c.c. Hempel flask with jack chain was used for rerunning the tops. A.S.T.M. equipment was used throughout for physical and chemical tests of products.

AVERAGE YIELD FROM UNTREATED CRUDE OIL

Properties of crude:		
Gravity, °A.P.I.		24.2
Sulphur, per cent		2.23
Ichthyol		None
Nitrogen, per cent		0.52
Aromatics, per cent		3.47
		Yield (pct.)
Gasoline		24.93
Gravity	51.5	
Endpoint, °F.	410	
Sulphur, per cent	0.43	
Corrosion	Neg.	
Kerosene distillate		4.00
Gravity	37.6	
Endpoint, °F.	500	
Sulphur, per cent	0.62	
Corrosion	....	
Gas oil		3.47
Gravity	33.0	
Endpoint, °F.	....	
Sulphur, per cent	1.50	
Corrosion	....	
Fuel oil		66.10
Gravity	14.8	
P.M. c.c. Fl., °F.	305	
Say. Fur. Vis., 122° F., secs.	219	
Sulphur, per cent	2.85	
Loss		1.50
Tops cut from over to 500° F. tower.		32.4
Gravity	46.8	
Sulphur, per cent	0.60	

Treatment of Crude Oil

In the case of aluminum chloride 410° F. endpoint gasoline was produced directly from the still. In the other cases tops were cut from the flask at 475° F. vapor temperature. These tops were rerun in a Hempel flask, cutting at 395° F. vapor temperature for gasoline.

In all cases, the raw gasoline obtained was given a caustic wash with approximately 2 per cent by volume of a 10 Be. caustic soda solution. The caustic washed gasoline was then treated in a separatory funnel using 66 Be. sulphuric acid, neutralized with 2 Be. caustic soda and water washed. In considering the chemicals to be used for sulphur reduction, it was decided first to try caustic soda. Theoretically 40 Be. caustic soda at the rate of 2 gallons per barrel of crude oil would be sufficient to remove all sulphur from the oil. Therefore, it was decided to make the first test, using this volume of caustic soda. The results from this run indicated a reduction in both the sulphur content of fuel and gasoline. However, the reduction was not sufficient to meet government specifications on the gasoline.

The second run was a duplicate of the first, with the exception that 4 gallons of 40 Be. caustic soda per barrel of crude oil were used instead of 2 gallons. The sulphur content of both gasoline and fuel oil was determined and found to be as high as on the first run. This necessitated a third run using caustic soda, which will be discussed later on.

The third run was conducted with aluminum chloride at the rate of 9 pounds per barrel of crude oil. The sulphur content of the products from this run was practically the same as the second caustic run.

Run No. 4 was an exact duplicate of run No. 3. The sulphur content, however, was considerably higher. The aluminum chloride used in these two runs had been standing in the laboratory for several years and no doubt had lost considerable available chlorine, so it was decided to purchase some fresh aluminum and repeat the tests.

In the meantime a distillation was made (run No. 5) using 10 pounds of lime per barrel of crude oil, which theoretically should have removed practically all of the sulphur. However, the sulphur in the products obtained from this run was extremely high showing that the lime had taken very little effect. Run No. 6 was conducted using 1 per cent by weight of cuprous oxide. This had very little influence on the sulphur content. Run No. 7 was conducted using 21 pounds of soda ash. This had very little effect on sulphur content.

Run No. 8 was conducted using 4¼ pounds of potassium bichromate per barrel. Results of this distillation showed a considerable decrease in the sulphur content of the gasoline but apparently had very little effect on the sulphur content of the fuel oil.

Run No. 9 was conducted using 4 pounds of potassium permanganate per barrel of crude. Results of this run showed the lowest sulphur content in the gasoline up to this time. However, the sulphur in the fuel oil was untouched.

Run No. 10 was a check on run Nos. 3 and 4, using fresh aluminum chloride. The sulphur content of the gasoline was high, but apparently in such form as to make it susceptible to acid treatment as this sulphur dropped 50 per cent in acid treatment although it was still higher than specifications allow. The sulphur content of the fuel oil is about the same as on the previous runs.

Run No. 11 was conducted using 4 gallons of 40 Be. caustic soda per barrel and was a check on run No. 2. The sulphur content of products obtained from this run were the best obtained from any previous run except No. 9, in which potassium permanganate was used. Run No. 12 was conducted without any chemicals but, during the entire run, air was blown through the oil in the still. The object of this was to oxidize the sulphur to such a form as to be susceptible to acid treatment. Results obtained from this run indicated that practically no reduction in sulphur was obtained.

Run No. 13 was conducted with 4 gallons per barrel of 40 Be. caustic soda. Results from this run checked run No. 11 very closely, although the sulphur content is slightly above specifications.

In addition to the work done in the treatment of crude oil, the following treats were made on tops and gasoline from untreated crude oil. Straightrun gasoline, which had been given a wash with 20° Be. caustic soda, then 10 pounds 66° Be. acid in five treats, neutralized with 2° Be. caustic soda and water washed, had a sulphur content of 0.96 per cent.

Gasoline from tops which had been given a wash with 20° Be. caustic soda, then 10 pounds 66° Be. acid in three treats, neutralized, washed and rerun in a Hempel flask, had a sulphur content of 0.08 per cent. Treating tops with bromine and washed with 10 per cent caustic soda did not reduce the sulphur content. Treating tops with sodium hydrochloride solution which contained 10 per cent free chloride and then treating with fuming sulphuric acid, reduced the sulphur content about 30 per cent.

Kerosene Treating

Following are the yields and tests of treating a commercial batch of kerosene distillate from Venice crude:

	Bbls.	Per cent
Finished kerosene	904	87.85
Loss	125	12.15
Kerosene distillate charge	1,029	100.00

	Pounds	Pounds per bbl.
66° Be. acid	11,144	10.32
Fuming acid	28,117	27.32
2° Be. caustic	44	0.04

(Continued on Next Page)

INVESTIGATING THE REMOVAL OF SULPHUR FROM VENICE CRUDE OIL

Run No.		Treatment and Procedure (All still charges 2,785 c.c.)	*Gaso., caustic scrubbed Yield (c.c.)	Sulphur (per cent)	Corr.	†Gaso., acid treated Sulphur (per cent)	Corr.	Fuel oil Grav.	B.s.&w. (pct.)	Carb. resid. (pct.)	Ash (pct.)	Sulphur (pct.)	Kerosene Sulphur scr. (pct.)
C-1	1	Two gallons 40 Be. caustic soda per barrel	864	0.18	Neg.	0.20	Neg.	16.2	0.2	10.38	1.02	1.04	....
C-2	3	Four gallons 40 Be. caustic soda per barrel	910	0.22	Neg.	0.16	Neg.	13.9	0.3	12.11	0.23	2.70	....
A-1	2	Nine pounds aluminum chloride per barrel (old chloride)	835	0.22	Pos.	0.32	Pos.	13.1	2.8	7.90	0.42	2.13	....
A-2	4	Nine pounds aluminum chloride per barrel (old chloride)	950	0.71	Pos.	0.42	Pos.	12.0	5.3	12.18	1.40	3.18	1.5
								(After standing 36 hours, b.s.&w. 2.80 pct.)					
L-I	5	Ten pounds lime per barrel	800	0.40	Pos.	0.38	Pos.	14.0	1.0	10.06	0.30	2.62	1.09
				0.41	Pos. (unscrubbed)								
Cu-I	6	One per cent by weight of cuprous oxide	900	0.31	Neg.	0.31	Neg.	16.1	0.3	9.70	1.6	2.17	....
S-1	7	Twenty-one pounds per barrel soda ash	925	0.35	Neg.	0.27	Neg.	15.8	0.3	9.63	1.38	3.19	....
P-4-1	8	Four and one-quarter pounds pot. bichro. per barrel	995	0.16	Neg.	0.16	Neg.	14.9	0.3	11.79	0.98	2.68	....
P-P-1	9	Four pounds potassium permanganate	975	0.10	Neg.	0.09	Neg.	14.8	0.3	9.64	1.01	2.31	....
A-3	10	Nine pounds aluminum chloride per barrel (fresh chlor.)	1,035	0.29	Pos. bad,	0.14	Pos., bad	15.1	3.0	9.56	0.94	2.18	....
C-3	11	Four gallons 40 Be. caustic soda per barrel	650	0.14	Neg.	0.11	Neg.	15.8	0.3	10.62	0.96	2.13	....
A-1-1	12	Air blown through crude while distilling	835	0.52	Neg.	0.37	Neg.	16.3	0.2	10.98	Trace	2.86	....
C-4	13	Four gallons 40 Be. caustic per barrel	810	0.16	Neg.	0.12	Neg.	15.4	0.3	10.22	0.38	2.52	....
	14	One per cent by weight of litharge (hot) held at 100 pounds pressure for one hour	Sulphur in crude after treating, pct., 2.20										
	15	Crude oil treated cold with metallic mercury for one hr.	Sulphur in crude after treating, pct., 2.21.										

Sulphur on original crude oil, 2.13 per cent.
Sulphur on gasoline from untreated crude, 0.29 per cent.
Sulphur on fuel oil from untreated crude, 2.35 per cent.

*All gasoline doctor sweet. †Acid treat in all cases was 2 pounds 66 Be. acid; all tests were doctor sweet.

Sulphur	Per cent
Original	0.62
After 8-lb. fuming	0.42
After 18-lb. fuming	0.239
After 28-lb. fuming	0.098
Finished 28-lb. fuming and 11-lb. 66°	0.086

	Charging	Finished
Gravity	37.6 A.P.I.	39.9 A.P.I.
Color	Brown	Plus 36
Sulphur	0.62%	0.086%
I.B.P.	434° F.	430° F.
Endpoint	496° F.	496° F.
Rec.	98.0%	98.0%
Per cent off at 437° F.	1.5%	2.0%
Flash	145° F.	160° F.

The lamp test on this kerosene gave a good chimney and a wick showing very little char and no toadstools.

Cracking Venice Crude

When distilling the crude oil, some hydrogen sulphide was evolved when the temperature reached 590° F. so it was decided to crack some of the topped crude in an attempt to reduce the sulphur content.

Following are the results of the cracking operation:

Charge	
Gravity	15.8 A.P.I.
Sulphur	2.77%

Synthetic Crude		Sulphur per cent
Gravity	18.9 A.P.I.	
Sulphur	2.39%	
Tops off at 500° F.	6.7%	2.31
Residuum	91.3%	1.99
Gasoline from rerun tops	4.1%	2.68

Temperature was raised slowly, three hours elapsing from application of heat until temperature of 785° F. was reached. At this temperature, the pressure was 700 lbs./sq. inch. The temperature was maintained at this point for 20 minutes. The bomb was allowed to cool slowly over night. Pressure after cooling was too low to read on the gauge. The pressure was released and the bomb opened. Much foaming indicated considerable amount of gas held in solution by the oil.

The tops from the synthetic crude were treated with 28° Be. doctor solution and water washed. The sulphur determination gave 2 per cent.

The gasoline from rerun untreated tops was given a doctor treat with 28° Be. doctor solution and washed with water. After this, it was given a treatment with 15 lbs./bbl. of 66° Be. sulphuric acid neutralized with 2° Be. caustic soda and water washed.

	Sulphur per cent
Doctor treated gasoline	2.97
Doctor treated and acid treated gasoline	1.26

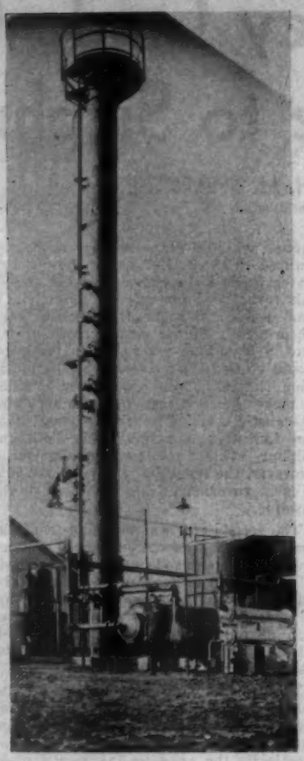
Summary

The results obtained from these various treats show that it is practically impossible to remove the sulphur in the fuel oil, but the sulphur content of the gasoline can be brought within government specifications by treating the crude oil with either potassium permanganate or caustic soda during distillation with subsequent low acid treatment. The sulphur in the gasoline may also be removed by giving the tops or gasoline from untreated crude oil an exceedingly high rate of acid treatment. The remaining treats did not lower the sulphur sufficiently to meet specifications.

On account of the excessive cost of treating this crude oil with permanganate also the cost and poor quality of the fuel obtained when using caustic soda, it would appear to be more desirable to treat gasoline from untreated crude with a high rate of acid as this method gives a marketable gasoline, also a fuel that is clean but high in sulphur.

A satisfactory kerosene can be made from this crude although the treating loss and quantity of acid required are very high. Cracking fuel from topped untreated crude oil lowers the sulphur content of resultant fuel about 30 per cent below that of the original charge, but yields a synthetic gasoline having a sulphur content over 1.25 per cent.

New Stabilizer Unit



Recent installation at Duncan, Okla. refinery of Rock Island Refining Co. Unit designed and installed by Petroleum Engineering, Inc.

Reforming Unit Aids in Refining Gasoline

(Continued from Page 58)

centrifugal. The charge pump is a 4"x12" horizontal duplex power pump driven by a 90-horsepower 17"x24" horizontal, single acting four-cycle gas engine. The quenching pump is a 4½"x8" vertical triplex power pump driven by a 40-horsepower three-cylinder vertical gas engine. No spare pumps are included and none are needed. Both of these pumps and their gas engines are manufactured by the National Transit Pump and Machine Co.

Relative Costs Shown

In order that the importance of the cost of pumping in a unit of this type might be appreciated, the Pennzoil Co. asked J. M. Sharp, chief engineer of the National Transit Pump & Machine Co., to prepare a tabulation of the relative costs of installation and operation of all types of drives that might be used with the charging pump. These data are shown in Figure 2. There no longer is any question of whether or not gas engines are suitable for driving pumps on cracking plants as a number have been in successful operation for several years.

There is very little automatic control on this unit. The total consists of one air operated pressure recorder controller with the valve in the gas line, leaving the receiver, one air operated temperature recorder controller with the valve in the discharge line of the pump refluxing the top of the tower, and one air operated pressure controller with the valve in a by-pass on the discharge line of the quenching oil pump controlling pressure of the quenching oil. Both gas engines are controlled by speed governors included with the installations, the pressure on the high pressure side of the unit is controlled manually by a remote valve mounted on the board, and the fires in the furnace are controlled by valves mounted on the board.

The rest of the instruments consist of flow meters, indicating and recording potentiometers, and indicating and recording pressure gauges. All these instruments are mounted on the control board so that the operator has knowledge of and may control any fluctuation of conditions without leaving the control house.

The design of this unit includes no unnecessary equipment. All equipment was purchased from the standpoint of lowest total cost, that is, installation, operation and maintenance. The unit delivers 80 per cent of the charge as main product which finds a ready market and 20 per cent of by-product, which may be accredited with its full valuation.

Continental Installs Switching Equipment

(Continued from Page 49)

shown will most clearly indicate the manner in which the various hookups may be arranged and there it will be seen that the two bus systems may be tied in together through an oil switch having an interrupting capacity of 52,000 amperes.

Frequency Controls

The public service generators serve as the basis for regulating the frequency of the refinery power plant, since there is some advantage in correlating the two. A sychroscope, mounted on the switchboard for the refinery generators permits the operator to synchronize his generators with those of the service company's in the usual manner, but in addition to this, the refinery plant is able to correlate its operation with that of the public service company on a frequency basis over a period of time as well. In other words, the frequency of the refinery power plant is held close to that of the service company by means of two electric clocks. One of these clocks runs on power supplied by the public service lines and the other on power supplied by the refinery generating system. The clocks will show the same time if the frequency of the two plants is exactly alike. If they are not alike, the refinery plant clock will either be lagging or ahead.

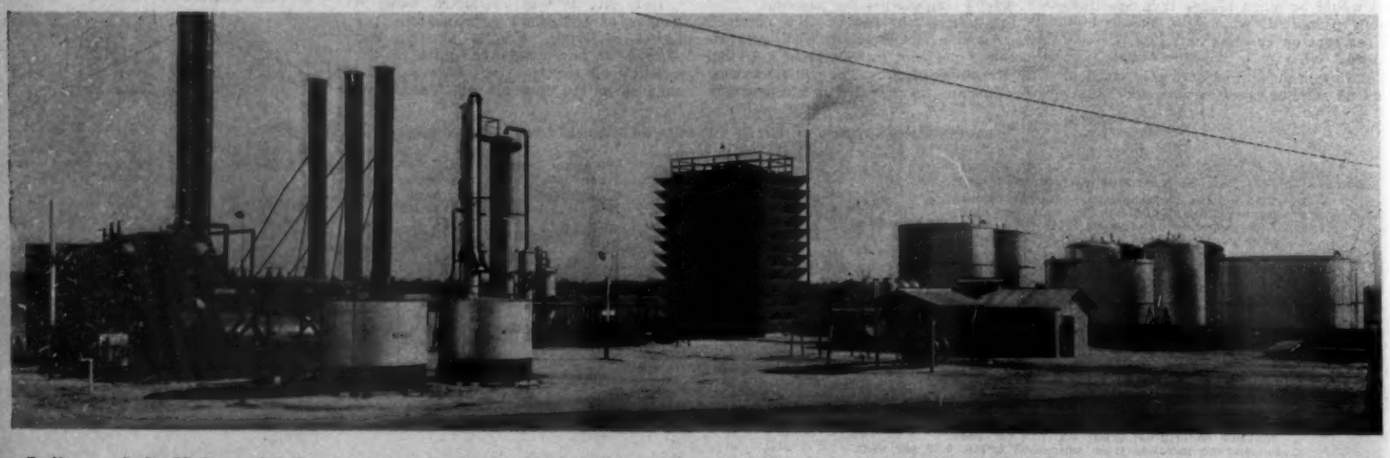
Assuming the public utility plant is accepted as the basis, the power plant operator may then vary the speed of his own generators to conform. This permits an accurate check on time for uniform control of the electric clocks throughout the plant, and all operations in or out of the refinery.

Exciter Set

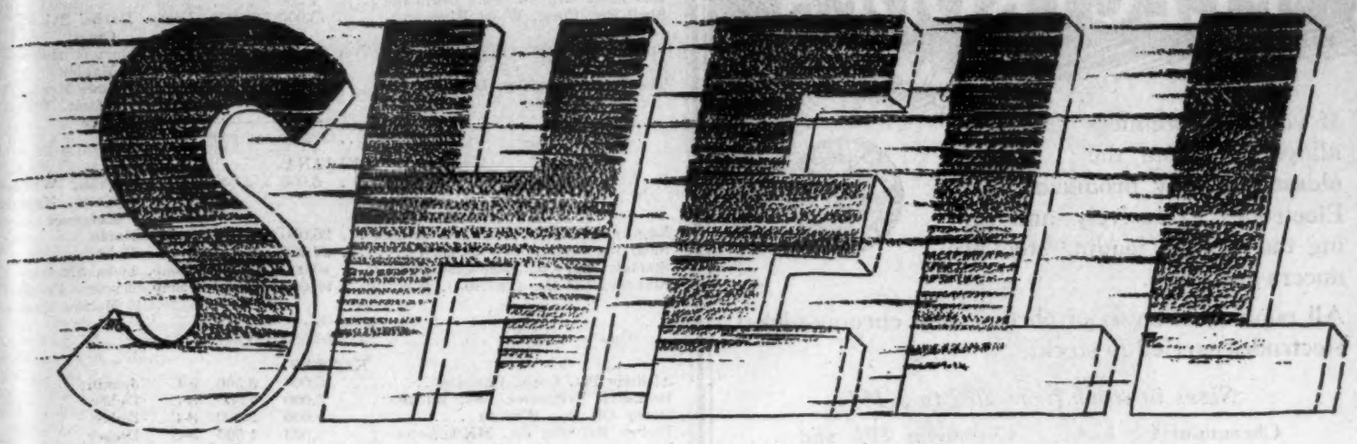
A 75-horsepower motor generator set, furnishing excitation for the refinery generators, is equipped so that in case of voltage failure to the motor operating on one source of power, that the motor is automatically switched to the other source for power, preventing any possibility of a shutdown.

Another feature of the new installation is the manner provided for distributing power to the substations. Underground conduits have been laid in place from the new board to certain stations and it is the present plan of the company to convert its present overhead power distributing lines to an underground system.

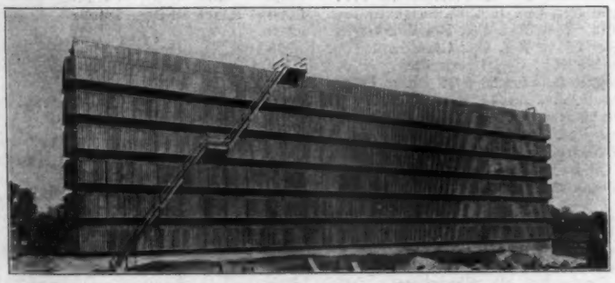
One of the New Plants Built in California During the Past Year



Refinery of the Mohawk Oil Co. located at Fruitvale, Calif., and operating with Fruitvale crude oil. Topping plant which has a capacity of 2,500 barrels daily was installed by Southwestern Engineering Corporation



Reduce Wind-Blown Spray with FLUOR VERTICAL AERATORS



Above is illustrated a modernized, Fluor Vertical Aerator-type Cooling Tower installation at an Oklahoma oil refinery where limited room and nearness of equipment made Positive Spray Elimination absolutely necessary.

The adaptability of the new Fluor Vertical Aerators to old-style cooling towers is a matter of complete satisfaction to plant owners in that the newly equipped towers will reduce wind-blown spray from 2% of total water volume circulated to as low as ¼ of 1%, with no plant shut-down during alteration. *Send for complete information at once.*

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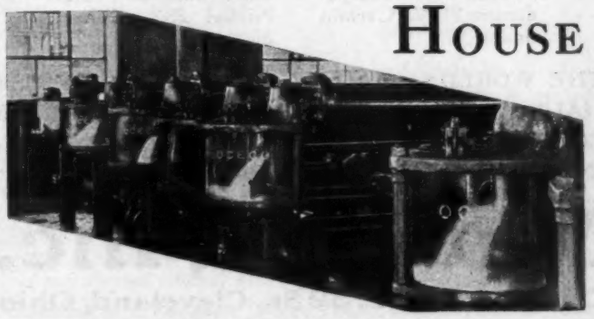

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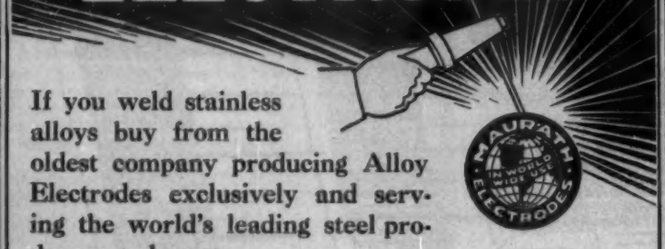

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Chromium 18%	Chromium 15% and Nickel 35%
Chromium 28%	Chromium 15% and Nickel 60%
Chromium 18% and nickel 8% Carbon under .07. Also made with titanium	Chromium 20% and Nickel 80%
Chromium 18% and Nickel 8% Silicon 2½%	Chromium 25% and Nickel 18% Silicon 2½%
Chromium 18% and Nickel 8% Molybdenum 2½%, Carbon under .07	Chromium 20% and Nickel 25% Silicon 2½%

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Gray Iron Castings
Special Analyses Castings for—

Oil Producers and Refiners

Chattanooga, Tennessee, U.S.A.

Record Number Operating Refineries in United States

(Continued from Page 41)

ILLINOIS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant	
Cross, Henry H., Co., Joliet	2,500	.....	S		
Cross, Henry H., Co., Dupo	1,000	.....	S		
Globe Oil & Ref. Co., Lemont	8,000	3,000	S-C	Winkler-Koch	
Indian Ref. Co., Lawrenceville	16,000	11,000	Comp.	Cross, DeFlorez	
Lincoln Oil Ref. Co., Robinson	10,000	9,600	Comp.	Holmes-Manley	
Lubrite Ref. Corp., East St. Louis	3,500	2,500	S-C	Pratt Vapor Phase	
Red River Ref. Co., Inc., Burnham	1,200	.....	L		
Shell Pet. Corp., Wood River	45,000	22,000	Comp.	Dubbs, T.V.P., Cross	
Standard Oil Co. (Indiana), Wood River	25,000	20,000	Comp.	Burton, Holmes-Manley	
The Texas Company, Lockport	20,000	16,000	S-C-A	Holmes-Manley, De Florez, Pressure Coke	
Total	132,200	84,100			

INDIANA

Bartles-Maguire Oil Co., East Chicago	6,000	4,000	S-C	Jenkins, Winkler-Koch, Naphtha Reformer
Empire Oil & Ref. Co., East Chicago	25,000	15,000	S-C	Dubbs
Shell Pet. Corp., East Chicago	27,000	13,000	S-C	Dubbs
Sinclair Ref. Co., East Chicago	40,000	30,000	Comp.	Isom, Sinclair
Standard Oil Co. (Indiana), Whiting	99,000	65,000	Comp.	Burton, Cross, Holmes-Manley
Total	197,000	127,000		

KANSAS

Altitude Pet. Corp., Chanute	5,000	3,500	S-C	Jenkins
Barnsdall Refineries, Inc., Wichita	5,000	1,500	S-C	Dubbs
Derby Oil Co., Wichita	8,000	3,000	S-C	Dubbs
Dickey Refining Co., McPherson	3,500	1,500	S-C	Dickey
Eldorado Ref. Co., Eldorado	4,500	2,500	S-C	Winkler-Koch
Falcon Refining Co., Great Bend†	1,000	.....	S	
Globe Oil & Ref. Co., McPherson	8,000	4,000	S-C	Winkler-Koch
Golden Rule Ref. Co., Wichita	1,000	1,200	S	Jenkins
Kanotex Ref. Co., Arkansas City	12,000	5,000	S-C	Jenkins, Donnelly
National Ref. Co., Coffeyville	5,500	2,500	S-C-L	National
Phillips Pet. Co., Kansas City*	10,000	2,500	S-C	Dubbs
Shell Pet. Corp., Arkansas City	20,000	5,100	S-C	Dubbs
Sinclair Ref. Co., Coffeyville	12,000	7,500	Comp.	Isom, Sinclair
Sinclair Ref. Co., Kansas City	11,000	5,000	S-C	Isom, Sinclair
Skelly Oil Co., Eldorado	8,000	10,000	S-C-A	Skelly
Standard Oil Co. (Indiana), Neodesha	20,000	15,000	S-C-A	Burton-Holmes-Manley
Sunflower Ref. Corp., Hutchinson	3,000	.....	S	
Vickers Pet. Co., Potwin	3,500	1,500	S-C	Dubbs
White Eagle Oil Corp., Augusta	16,000	10,000	S-C	White Eagle
Total	166,000	81,300		

*Plant owned by Independent Oil & Gas Co., a subsidiary of Phillips Pet. Co.
†Under construction March 15, 1933.

KENTUCKY

Aetna Oil Service, Inc., Louisville	1,500	400	S-C	Fleming
Ashland Ref. Co., Inc., Catlettsburg	4,000	2,000	S-C	Dubbs
Bowling Green Ref. Co., Bowling Green	1,500	.....	S	
Glasgow Oil & Ref. Co., Glasgow	250	.....	S	
Greenville Ref. Co., Greenville	100	.....	S	
Latonia Ref. (Standard Oil Co. of Ohio), Latonia	8,000	4,000	S-C	Tube & Tank
Louisville Ref. Co., Inc., Louisville	4,000	1,800	S-C	Dubbs
Simrall Ref. Corp., Horse Cave	2,000	.....	S	
South Kentucky Pipe Line Co., Somerset	1,000	.....	S	
Stoll Oil Ref. Co., Louisville	3,000	2,500	S-C-L	Stoll
The Texas Company, Pryse	2,000	2,000	S-C-L	Holmes-Manley
Total	57,350	12,700		

LOUISIANA

Bayou State Ref. Corp., Hosston	600	.....	L	
Cedar Grove Ref. Co., Shreveport	1,500	.....	S	
Chalmette Pet. Corp., Chalmette	6,000	3,000	S-C	Winkler-Koch
Louisiana Oil Ref. Corp., Bossier City	15,000	22,000	S-C	Tube & Tank
Louisiana Oil Ref. Corp., Shreveport	3,000	.....	A	
Mexican Pet. Corp. of La., Destrehan	20,000	.....	S-A	
Shell Pet. Corp., Norco	16,000	7,200	S-A-C	Dubbs
Stanolind Oil & Gas Co., Superior	5,000	2,200	S-C	Cross
Spartan Ref. Co., Inc., Shreveport	12,000	.....	S	
Standard Oil Co. of La., Baton Rouge	100,000	40,000	Comp.	Tube & Tank
The Texas Company, Ardis (Shreveport)	6,500	.....	S	
Williams Ref. Co., Shreveport	400	.....	S	
Total	186,000	74,400		

MARYLAND

Continental Oil Co., Baltimore	10,000	7,000	S-C	Dubbs, Cross
Mexican Pet. Corp., Baltimore	8,000	.....	A	
Standard Oil Co. of New Jersey, Baltimore	32,000	52,572	Comp.	Tube & Tank
Total	50,000	59,572		

MASSACHUSETTS

Cities Service Ref. Co., East Braintree	20,000	6,300	Comp.	Doherty, Holmes-Manley
Colonial Beacon Oil Co., Everett	28,000	24,000	S-C-A	Tube & Tank
Total	48,000	30,300		

(Continued on Next Page)

MICHIGAN

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Naph-Sol Ref. Co., Muskegon	2,500	.....	S	
Old Dutch Ref. Co., Muskegon	3,000	.....	S	
Pure Oil Co., Midland	3,500	.....	S	
Roosevelt Oil Co., Mount Pleasant	2,500	.....	S	
White Star Ref. Co., Trenton	7,000	6,600	S-C	Dubbs, Controlled Coil
Total	18,500	6,600		

MISSOURI

Altitude Pet. Corp., Kansas City	3,500	.....	S	
Joplin Ref. Co., Joplin	1,500	1,000	S-C	Jenkins
Standard Oil Co. (Ind), Sugar Creek	18,000	15,000	Comp.	Burton-Holmes-Manley
Total	23,000	16,000		

MONTANA

Arro Oil & Ref. Co., Lewistown	2,000	1,000	S-C	Dubbs
Bighorn Oil & Ref. Co., Billings	400	.....	S-A	
Big West Oil Co., Kevin	1,200	.....	S	
Boris, A. S. Aronow, Kalispell	2,000	1,000	S-C	Vapor phase
Boris, A. S. Aronow, Havre	400	.....	S	
Conrad Ref. Co., Conrad	1,000	.....	S	
Consumers Ref. Co., Collins	500	.....	S	
Continental Oil Co., Lewistown	1,500	.....	S	
Hart Refineries, Hedgesville	100	.....	S	
Hart Refineries, Missoula	300	.....	S	
Home Oil & Ref. Co., Great Falls	2,500	.....	S	
Northwest Stellarene Co., Shelby	2,000	.....	S	
Russell Oil Co., Butte	1,000	.....	S	
Russell Oil Co., Billings	1,800	.....	S	
Snow Cap Oil Co., Sunburst	350	200	S	Experimental
The Texas Company (International), Sunburst	4,500	2,500	S-C	deFlorez
Toole County Ref. Co., Oilmont	300	.....	S	
Yale Oil Corp. of S. Dak., Billings	2,000	.....	S	
Total	23,850	4,700		

NEW JERSEY

Barber Asphalt Co., Maurer*	6,000	2,500	S-C-A	Cross
Crew Levick Co., Pettys Island	8,000	4,500	S-C	Doherty
Gulf Ref. Co., Bayonne	30,000	1,000	S-C	Gulf
Standard Oil Co. of N. J., Bayonne	88,000	29,714	Comp.	Modified Tube & Tank
Standard Oil Co. of N. J., Linden	75,000	172,571	Comp.	Tube & Tank
Standard Oil Co. of N. J., Jersey City	17,000	.....	L	
Tide Water Oil Co., Bayonne	50,000	25,000	Comp.	Tube & Tank
Vacuum Oil Co., Inc., Paulsboro	20,000	9,000	Comp.	Cross, Ellis
Warner-Quinlan Oil Co., Warners	20,000	.....	S-A	
Total	314,000	244,285		

*Cracking plant operated by Betrin Petroleum Co.

NEW YORK

Gulf Ref. Co., Staten Island	15,000	.....	S	
Sinclair Ref. Co., Wellsville	10,000	5,000	Comp.	Isom, Sinclair
Standard Oil Co. of N. Y., Brooklyn and Long Island City	19,000	10,000	Comp.	Cross, deFlorez
Standard Oil Co. of N. Y., Buffalo	5,000	4,000	Comp.	Cross, deFlorez
Vacuum Oil Co., Inc., Olean	6,500	3,000	Comp.	Cross, Ellis
Total	55,500	22,000		

NEW MEXICO

Basin Refining Co., Aztec	50	.....	S	
Continental Oil Co., Farmington	1,000	.....	S	
Continental Oil Co., Artesia	1,500	.....	S	
Continental Oil Co., Albuquerque	1,000	.....	S	
Malco Ref., Inc., Artesia	1,000	.....	S	
Pecos Diamond Ref. Co., Artesia	250	.....	S	
Valley Ref. Co., Roswell	500	250	S-C	Valley
Total	5,300	250		

OHIO

Allegheny-Arrow Oil Co., Canton	1,200	750	S-C	Dubbs
Gulf Ref. Co., Toledo	13,000	6,000	S-C	Gulf
Gulf Ref. Co., Cincinnati	11,000	6,000	S-C-A	Gulf
Canfield Oil Co., Cleveland	1,000	.....	L	
National Ref. Co., Findlay	2,000	.....	L	
National Refining Co., Marietta	580	.....	L	
Peninsula Oil Co., Catawba Island	60	.....	S	
Pure Oil Co., Heath	9,000	9,000	S-C	Gyro, Cross
Pure Oil Co., Toledo	6,500	5,400	S-C	Gyro
Stellar Ref. Co., Marne (Newark)	1,000	250	S-C	Leamon
Standard Oil Co. of Ohio, Cleveland	20,000	10,000	Comp.	Tube & Tank
Standard Oil Co. of Ohio, Toledo	12,000	4,000	Comp.	Tube & Tank
Standard Oil Co. of Ohio, Lima	7,500	11,000	S-C	Solar, Cross
Sun Oil Co., Toledo	14,000	6,000	S-C	Sun
Superoil Co., Toledo	350	.....	L	
Total	99,190	58,400		

OKLAHOMA

Altitude Pet. Corp. (Peacock refinery), Oklahoma City	2,500	.....	S	
Anderson-Prichard Oil Corp., Oklahoma City	6,000	3,000	S-C	Winkler-Koch
Barnsdall Refs., Inc., Okmulgee	11,000	4,500	S-C	Cross

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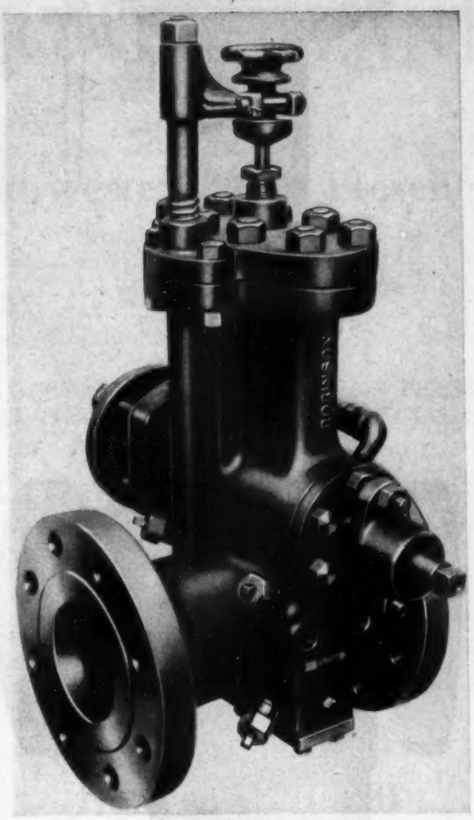

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OKLAHOMA (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Barnsdall Refs., Inc., Barnsdall	5,000	4,000	S-L-C	Cross
Bell Oil & Gas Co., Grandfield	4,500	1,700	S-C	Dubbs
Black Gold Ref. Co., Oklahoma City	1,500	750	S-C	Black Gold
Century Pet. Co., Oklahoma City	2,500	.....	S	
Champlin Ref. Co., Enid	15,000	6,000	S-C-L	Cross-Winkler-Koch
Cole, L. S., Ref. Co., Oklahoma City	500	.....	S	
Columbia Ref. Co., Oklahoma City	2,500	.....	S	
Continental Oil Co., Ponca City	30,000	13,000	Comp.	Dubbs, Cross
Cushing Refining & Gasoline Co., Cushing	3,500	.....	S	
Cushing Refining & Gasoline Co., Blackwell	1,800	.....	S	
Crescent Ref. Co., Holdenville	2,000	.....	S	
Deep Rock Oil Corp., Cushing	10,000	4,000	Comp.	Dubbs
Eason Oil Co., Enid	5,000	2,000	S-C	Jenkins
Empire Oil & Ref. Co., Okmulgee	4,000	1,000	S-C-L	Doherty
Empire Oil & Ref. Co., Ponca City	12,000	4,500	Comp.	Dubbs, Doherty
Firestone Ref. Co., Oklahoma City	2,000	.....	S	
Garber Refs., Inc., Garber	4,500	2,000	S-C	Winkler-Koch
Globe Oil & Ref. Co., Blackwell	8,000	4,000	S-C	Winkler-Koch
Johnson Oil Ref. Co., Cleveland	6,000	2,000	S-C	Dubbs
Major Petroleum Products Co., Oklahoma City	1,500	.....	S	
Marathon Oil Co., Bristow	5,000	1,500	S-C	Cross
Marathon Oil Co., Boynton	2,500	.....	S-L	
Mid-Continent Pet. Corp., Tulsa	40,000	15,000	Comp.	Mid-Continent
Oklahoma City Ref. Co., Oklahoma City	2,500	.....	S	
Pilgrim, Inc., Ardmore	70	.....	L	
Phillips Pet. Co., Okmulgee*	7,000	2,500	S-C-L	Dubbs
Producers Oil Co., Bristow	1,500	.....	S	
Producers & Refiners Corp., Tulsa	6,000	3,000	S-C	Dubbs
Pure Oil Co., Ardmore	3,000	2,400	S-C	Dubbs
Pure Oil Co., Muskogee	9,000	6,700	Comp.	Cross, Gyro
Rock Island Ref. Co., Beckett	5,000	2,000	S-C	Winkler-Koch
Sinclair Ref. Co., Sand Springs	8,000	2,500	S-C-L	Cross
Singleton Ref. Co., Oklahoma City	500	.....	S	
Sterling Ref. Co., Oklahoma City	2,000	.....	S	
Sun Oil Co., Yale	5,000	.....	S	
Sunray Oil Co., Allen	6,000	.....	S-A	
Texas Pacific Coal & Oil Co., Wynnewood	3,000	.....	A	
The Texas Company, Tulsa	14,000	18,500	S-C	Holmes-Manley, Pressure Coke
Tide Water Oil Co. of Okla., Drumright	18,000	7,500	S-C	Tube & Tank, Modified Burton
Western Oil Corp., Beckett	2,000	1,200	S-C	Jenkins
Wilcox, H. F., Oil & Gas Co., Bristow	5,000	1,200	S-C	Dubbs
Wirt Franklin Pet. Corp., Ardmore	4,000	.....	S	
Yale Oil Corp., Yale	2,000	.....	S	
York Ref. Co., Oklahoma City	3,000	.....	S	
Total	295,370	116,450		

*Plant owned by Independent Oil & Gas Co. (a subsidiary of Phillips Petroleum Co.). Only cracking unit operating.

PENNSYLVANIA

Atlantic Ref. Co., Philadelphia	50,000	31,800	Comp.	Lewis, Cross, deFlorez
Atlantic Ref. Co., Franklin	9,000	6,000	Comp.	Cross
Atlantic Ref. Co., Pittsburgh	8,000	4,000	Comp.	Cross
James B. Berry Sons' Co., Inc., Oil City†	2,500	.....	S-L	
Bradford Penn Ref. Corp., Clarendon	500	.....	S-L	
Bradford Oil Refining Co., Bradford	1,500	.....	S-L	
Canfield Oil Co., Coraopolis	1,000	.....	S-L	
Carnegie Ref. Co., Carnegie	1,000	.....	S-L	
Continental Ref. Co., Oil City	1,000	*2,500	S-C-L	Dubbs
Conewango Ref. Co., North Warren	2,000	.....	S-L	
Crew-Levick Co., Titusville	3,000	.....	S-L	
Crystal Oil Works, Rouseville	1,000	.....	S-L	
Daugherty, W. H., & Son Ref. Co., Petrolia	2,000	.....	S-L	
Franklin Creek Ref. Co., Franklin	1,000	.....	S-L	
Freedom Oil Works Co., Freedom	2,000	.....	S-L	
Freedom Oil Works Co., Coraopolis	500	.....	S-L	
Gulf Ref. Co., Philadelphia	32,000	19,000	Comp.	Gulf
Gulf Ref. Co., Pittsburgh	6,500	3,000	S-C	Gulf
Kendall Ref. Co., Bradford	3,500	2,500	Comp.	Dubbs
Miller, A. D., Sons Co., Pittsburgh	1,000	500	S-L	Miller
Oil Creek Refining Co., East Titusville	1,000	.....	S-L	
Pennsylvania Oil Products Co., Eldred	5,000	1,000	S-C-L	Conerty
Pennsylvania Ref. Co., Karns City	2,000	.....	S-L	
Pennsylvania Ref. Co., Titusville	1,500	.....	S-L	
Pennzoil Co., The, Rouseville	8,000	4,500	Comp.	Dubbs
Pure Oil Co., Marcus Hook	15,000	16,200	S-C	Cross, Gyro
Quaker State Oil Ref. Corp., Farmers Valley	3,000	1,500	Comp.	Dubbs
Quaker State Oil Ref. Corp., Emlenton	2,000	1,000	Comp.	Dubbs
Sherwood Ref. Co., Warren	750	.....	S-L	
Sinclair Ref. Co., Marcus Hook	20,000	10,000	S-C	Isom, Sinclair
Superior Oil Works, Warren	500	.....	S-L	
Starlight Ref. Co., Karns City	600	.....	L	
Sun Oil Co., Marcus Hook	45,000	15,000	Comp.	Sun
The Texas Company, Marcus Hook	1,500	.....	A	
Tiona Ref. Co., Clarendon	1,000	.....	S-L	
Ultra-Penn Ref. Co., Butler	1,000	.....	S-L	
United Ref. Co., Warren	2,000	.....	S-L	
Valvoline Oil Co., Butler	3,000	.....	S-L	
Valvoline Oil Co., Warren	1,500	.....	S-L	
Waverly Oil Works Co., Pittsburgh	1,000	.....	S-L	

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PENNSYLVANIA (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Wolverine-Empire Ref. Co., Reno	1,200	.....	S-L	
Wolverine-Empire Ref. Co., Tidioute	800	.....	S-L	
Total	246,350	118,500		

*Cracking plant owned jointly by Pennzoil Co., James B. Berry Sons' Co., Inc., Wolverine, Empire Refining Co. and Continental Refining Co.

†This plant formerly operated under name of Independent Refining Co. Company is affiliated with Quaker State Oil Refining Corp.

RHODE ISLAND

Standard Oil Co. of N. Y., Inc., Providence	10,000	6,000	S-C-A	Cross
The Texas Company, Providence	1,500	.....	A	
Total	11,500	6,000		

SOUTH CAROLINA

Standard Oil Co. of N. J., Charleston	6,000	.....	A	Tube & Tank

TEXAS

Alamo Ref. Co., Camps Switch	2,500	.....	S	
Allstate Ref. Co., Thrall	2,500	.....	S	
American Pet. Co., Houston	4,000	.....	S	
Arp Refining Co., Arp	500	.....	S	
Arrow Refining & Producing Co., Overton	3,000	.....	S	
Archer Ref. Corp., Megargel	1,500	.....	S	
Beacon Oil & Ref. Co., Henderson	3,500	.....	S	
Bluebonnett Oil Ref. Co., Wickett	5,000	.....	S	
Bobrose Oil & Ref. Co., Luling	2,500	.....	S	
Canyon Refining Co., Kilgore	200	.....	S	
Carnation Ref. Corp., Gladewater	200	.....	S	
Carson, M. D., Brady	75	.....	S	
Concho Ref. Co., San Angelo	200	.....	S	
Conroe Oil & Ref. Co., Conroe	250	.....	S	
Constantin Ref. Co., Overton	1,000	500	S-C	Constantin
Continental Oil Co., Wichita Falls	5,000	2,300	S-C	Continental
Cooke, R. X., Gladewater	200	.....	S	
Cosden Oil Co., Big Spring	10,000	5,000	S-C	Jenkins
Col-Tex Ref. Co., Colorado	10,000	4,000	S-C	Richmond
Crescent Oil & Ref. Co., Houston	1,000	.....	S	
Crown Central Pet. Corp., Houston	8,000	6,000	S-C	Holmes-Manley
Dale Oil & Ref. Co., Wichita Falls	4,000	.....	S	
Diamond Refining Co., Overton	2,500	.....	S	
Dixon Creek Oil & Ref. Co., Kings Mill*	2,500	.....	S	
East Texas Ref. Co., Longview	10,000	3,000	S-C	East Texas
Empire Oil & Ref. Co., Gainesville	4,000	2,000	S-C	Dubbs
Exchange Pet. Co., Albany	300	.....	S	
Falls Refining Co., Wichita Falls	2,500	.....	S	
Gilliland Oil Co., Gladewater	1,000	.....	S	
Gratex Ref. Co., Graham	500	.....	S	
Grayburg Oil Co., San Antonio	2,500	1,000	S-C	Dubbs
Gladewater Ref. Co., Gladewater	500	.....	S	
Gregg Ref. Co., Gladewater	300	.....	S	
Gulf Ref. Co., Port Arthur	125,000	50,000	Comp.	Gulf
Gulf Ref. Co., Fort Worth	6,000	3,000	S-C	Gulf
Gulf Ref. Co., Sweetwater	5,000	4,000	S-C	Gulf
Haskell Oil Ref. Corp., Breckenridge	200	.....	S	
Houston Oil Co. of Texas, Viola	1,000	.....	S	
Howard County Ref. Co., Big Spring	2,500	.....	S	
Humble Oil & Ref. Co., Ingleside	12,000	7,800	S-C	Tube and Tank
Humble Oil & Ref. Co., Baytown	80,000	60,000	Comp.	Tube & Tank, Cross
Humble Oil & Ref. Co., San Antonio	4,500	.....	S-A	
Humble Oil & Ref. Co., Neches	5,000	.....	S	
Johnsonville Ref. Co., Omega	200	.....	S	
Kent Refining Co., Minerva	2,000	.....	S	
Kilgore Ref. Co., Kilgore	1,500	750	S-C	
Lake Ref. Co., Gladewater	500	.....	S	
Locke Ref. Co., Gladewater	200	.....	S	
LaSalle Petroleum Co., Burkburnett	3,500	.....	S	
Maritime Oil Co. (Deepwater plant), Houston	3,000	.....	S-A	
Master Pet. Co., Waco	1,000	.....	S	
Magnolia Pet. Co., Beaumont	70,000	55,000	Comp.	Cross
Magnolia Pet. Co., Fort Worth No. 1	4,500	3,000	S-A-C	Cross
Magnolia Pet. Co., Fort Worth No. 2	2,600	750	S-A-C	Controlled Coil
Magnolia Pet. Co., Corsicana	4,000	.....	S	
Magnolia Pet. Co., Luling	5,000	3,750	S-C	Controlled Coil
Marathon Oil Co., Fort Worth	5,000	1,500	S-L-C	Cross
Marathon Oil Co., Del Rio	2,500	.....	S	
Mentone Oil & Ref. Co., Mentone	300	.....	S	
Misko Refs., Inc., Laredo	1,500	1,500	S-C-L	Misko
Montana Oil & Ref. Co., Arno	1,000	.....	S	
Moon Ref. Co., Graham	500	.....	S	
Moutray Oil Co., Hawley	750	.....	S	
Muenster Ref. Co., Muenster	300	.....	S	
Octane Oil Ref. Co., Baird	1,500	1,000	S-C	Dayson
Olney Oil & Ref. Co., Olney	2,500	1,500	S-C	Olney
Oriental Oil Co., Dallas	4,500	.....	S	
Overton Ref. Co., Overton	4,000	750	S-C	Overton
Panama Ref. Co., Kilgore	400	.....	S	
Panhandle Ref. Co., Wichita Falls	3,000	1,700	S-C	Dubbs
Paramount Refineries, San Angelo	2,000	.....	S	
Pasotex Pet. Co., El Paso	14,000	4,000	S-C	Dubbs
Pennant Ref. Co., Kilgore	250	.....	S	
Pentex Ref. Co., Echo	400	.....	S	
Phoenix Ref. Co., Pettus	600	.....	S	
Phoenix Ref. Co., Inc., Dallas	1,000	.....	S	
Petroleum Refractionating Corp., Pampa	6,500	1,500	S-C	Winkler-Koch
Phillips Petroleum Co., Borger	30,000	12,000	S-C	Phillips
Pilot Point Ref. Co., Pilot Point	500	.....	S	
Pioneer Oil & Ref. Co., Somerset	2,000	.....	S-L	
Pure Oil Co., Smiths Bluff (Nederland)	30,000	25,000	Comp.	Gyro, Cross
Recla Ref. Co., Turnerstown	200	.....	S	

(Continued on Next Page)

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FORT WORTH, TEXAS

TEXAS (Continued)

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Reese Ref. Co., Arp	200	.....	S	
Republic Oil Ref. Co., Texas City	5,000	1,500	S-C	Winkler-Koch
Rusk Ref. Co., Overton	3,000	.....	S	
Sabine Refining Co., Gladewater	200	.....	S	
San Angelo Ref. Co., San Angelo	2,000	.....	S	
Shamrock Oil & Gas Co., Sunray	2,800	.....	S	
Shell Petroleum Corp., Houston	29,000	18,200	S-C	Dubbs
Shoreline Ref. Co., Kilgore	300	.....	S	
Simms Oil Co., Dallas	4,000	2,000	S-C	Cross
Sinclair Ref. Co., Camp Switch (near Gladewater)	1,500	.....	S	
Sinclair Ref. Co., Houston	31,000	25,000	S-C	Isom, Sinclair
Sinclair Ref. Co., Fort Worth	4,000	.....	S	
Sinclair Ref. Co., El Paso	5,000	.....	S	
Solar Refining Co., Overton	3,000	.....	S	
Southern Oil Ref. Co., Kilgore	3,500	.....	S	
Southland Ref. Co., Olney	1,000	.....	S	
Star Ref. & Prod. Co., Fort Worth	1,500	750	S-C	Star
Stone Oil Co., Texas City	5,000	2,000	S-C	Jenkins
Taxman Ref. Co., Wichita Falls	3,500	1,500	S-C	Donnelly
Taylor Ref. Co., Tyler	15,000	10,000	S-C	Rowsey
Taylor Ref. Co., Taylor	5,000	3,000	S-C	Rowsey
The Texas Company, Port Arthur	60,000	96,000	Comp.	Holmes-Manley, deFlorez, Pressure Coke
The Texas Company, West Dallas	16,000	9,600	S-C	Holmes-Manley, deFlorez, Pressure Coke
The Texas Company, Amarillo	4,000	3,200	S-C	Pressure Coke, deFlorez
The Texas Company, Port Neches	20,000	.....	A	
The Texas Company, Houston	20,000	1,000	S-C	Tube & Tank
The Texas Company, San Antonio	3,000	3,000	S-C	Holmes-Manley
The Texas Company, El Paso	1,500	1,500	S-C	Holmes-Manley
Texas Oil Products Co., Gladewater	1,000	.....	S	
Texas Pacific Coal & Oil Co., Fort Worth	3,000	1,000	S-C-L	Cross
Texas Pacific Coal & Oil Co., Caddo	1,000	.....	S	
Texas Pet. Products Co., Somerset	2,000	.....	S	
Trinity Refining Co., Gladewater	350	.....	S	
Unit Ref. Co., Kilgore	200	.....	S	
Waggoner Ref. Co., Inc., Electra	4,500	2,000	S-C	Waggoner
West Texas Ref. Co., Pecos	6,000	4,000	S-C	†Jenkins
White Star Ref. Co., Cisco	500	.....	S	
Wickett Refining Co., Wickett	2,000	.....	S	
Total	316,675	447,550		

*Leased by Panhandle Refining Co. †Owned by Pecos Refining Co.

UTAH

Utah Oil Ref. Co., Salt Lake City	6,500	8,900	Comp.	Modified Burton, Holmes-Manley
Wasatch Oil Refining Co., Woods Cross	1,000	600	S-C	Vapor Phase
Total	7,500	9,500		

VIRGINIA

The Texas Company, Norfolk	1,500	.....	A	

WEST VIRGINIA

Carbide & Carbon Chemicals Corp., South Charleston	1,000	1,000	S-C	Gyro
Elk Ref. Co., Falling Rock	2,250	.....	S-L	
Ohio Valley Ref. Co., St. Marys	2,000	750	Comp.	Dubbs
Pure Oil Co., Cabin Creek	3,500	1,500	S-L-C	Gyro
Standard Oil Co. of N. J., Charleston	5,500	13,714	Comp.	Tube & Tank
Tri-State Ref. Co., Kenova	2,500	2,000	S-C	Jenkins
Total	16,750	18,964		

WYOMING

Continental Oil Co., Glenrock	4,000	3,000	S-C	Cross
Egaso Operating Co., Osage	750	.....	S-C	Cross
Goshen Oil Ref. Co., Torrington	250	.....	S	
Gillette Ref. Co., Gillette	100	.....	S	
Midland Oil Ref. Co., Osage	300	.....	S	
Standard Oil Co. (Ind.), Casper	12,600	17,850	Comp.	Burton
Standard Oil Co. (Ind.), Greybull	5,000	2,500	S-C	Burton
Producers & Refiners Corp., Parco	8,000	4,000	S-L-C	Dubbs
The Texas Company, Casper	7,000	6,500	S-C	Holmes-Manley, Pressure Coke
The Texas Company, LaBarge	300	.....	S	
White Eagle Oil Corp., Casper	5,000	3,500	S-C	White Eagle
Star Refinery, Osage	75	.....	S	
Wyoming Gas & Oil Co., Upton	100	.....	S	
Wyoming Oils, Inc., Casper	250	.....	S	
Total	43,725	40,350		

SHUT DOWN REFINERIES IN UNITED STATES

The following tables list the shut down refineries in United States as of March 15. The following abbreviations are used: S—skimming; C—cracking; L—lubricating oils; A—asphalt.

ALABAMA

Coastal Pet. Corp., Mobile	6,000	.....	S-C	Coastal

ARIZONA

Rio Grande Oil Co., Phoenix	1,000	.....	S	

ARKANSAS

E. M. Tulle Ref., El Dorado	1,000	.....	S	
Houston Oil Co., Camden	3,500	.....	S-C	Dubbs
Union Asphalt Co., El Dorado	2,000	.....	S-C	Union
Total	6,500	.....		

(Continued on Next Page)

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CALIFORNIA

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
Capitol Crude Oil Co., Santa Paula	100		S	
California Northern Oil Co., Coalinga	200		L	
Champion Gasoline Co., Long Beach	3,500		S	
Cherry Oil Co., Hynes	1,500		S	
Consolidated Pacific Ref. Co., Santa Fe Springs	1,000		S	
Crescent Oil & Ref. Co., Los Angeles	6,000		S	
East West Ref. Co., Los Angeles	1,000		S	
General Petroleum Corp., Olinda	2,000		S	
Hart Dearing Ref. Co., Fellows	2,500		S	
Hercules Gasoline Co., Los Angeles	5,500		S-C-A	Jenkins
Holly Oil Co., Huntington Beach	3,000		S	
Orange County Ref. Co., Newport	1,000		S	
Palisades Oil & Ref. Co., Vinvale	3,500		S	
Petroleum Specialties Co., Los Angeles	2,000		S	
Producers Ref. Co., Kern River	500		L	
Richfield Oil Co., Los Angeles	4,000		S	
Richfield Oil Co., Bakersfield	2,000		S	
Rotary Process Ref. Co., Ltd., Bell	3,000		S-C	Rotary
Seaboard Pet. Corp., Los Angeles	2,000		S	
Signal Oil & Gas Co., Hynes	8,000		S	
Southwest Ref. & Sales Co., Long Beach	2,000		S	
Sunset Pacific Oil Co., Los Angeles	8,600		S	
Springs Oil & Ref. Co., Santa Fe Springs	500		S	
The Texas Company (Calif.), Coalinga	500		S	
Torrance Oil & Ref. Co., Torrance	5,000		S	
Union Oil Co. of Calif., Brea	6,000		S	
Union Oil Co. of Calif., Avila	10,000		S	
Union Pacific Oil Co., Long Beach*	2,500		S	
Vernon Oil Ref. Co., Vernon	2,000		S	
Vulcan Refining Co., Los Angeles	1,500		S-C	Vulcan
Western States Pet. Corp., Long Beach	5,000		S	
Wilshire Oil Co., Fellows	2,500		S	
Total	98,400			

*Now owned by Mission Oil Co.

ILLINOIS

Barber Asphalt Co., Madison	700		A	
Interocean Ref. Co., McCook	5,000		S-L	
Lubrite Ref. Co., Wood River	4,000		S-C	Dubbs
Total	9,700			

INDIANA

Portland Oil & Ref. Co., Portland	600		S	
Interstate Gasoline Co., East Chicago	2,500		S	
Total	3,100			

IOWA

MonaMotor Oil Co.	1,500		S	

KANSAS

Grant Oil Co., Augusta	2,500		S	
Richardson Ref. Co., Eldorado	1,500		S	
Total	4,000			

KENTUCKY

Central Prod. & Ref. Co., Bowling Green	600		S	
Great Southern Ref. Co., Lexington	2,500		S-L	
Neha Ref. Co., Lexington	800		S	
Standard Oil Co. of Ky., Louisville	5,000		S-C	Burton
Total	8,900			

LOUISIANA

Crystal Oil Ref. Co., Shreveport	10,000		S-C	Jenkins
Great Southern Ref. Co., Ardis	2,000		S	
Red River Ref. Co., Crichton	1,800		S	
Sinclair Ref. Co., Meraux	30,000		A	
Gupeco Ref. Co., Inc., Alexandria	600		S	
Total	44,400			

MARYLAND

Interocean Oil Co., Baltimore	7,000		S-C	Leamon

MICHIGAN

Henry H. Cross Co., Muskegon	2,000		S	
Standard Oil Co. (Ind.), Zilwaukee	1,500		S	
Total	3,500			

MONTANA

American Ref. Co., Great Falls	1,000		S	
Laurel Oil & Ref. Co., Laurel	5,000		S-C	Laurel
Montana Ref. Co., Billings	750		S	
Round Up Oil & Ref. Co., Butte	200		S	
Yale Oil Corp., Miles City	800		S	
Total	7,750			

NEW JERSEY

Middlesex Ref. Co., New Brunswick	5,000		S-C	Emerson

NEW MEXICO

Bloomfield Oil & Gas Co., Bloomfield	300		S	
State Oil & Ref. Co., Dayton	2,500		S	
Sullivan Refs., Inc., Dayton	1,500		S	
Total	4,300			

OHIO

Craig Oil Co., Toledo	1,500		S-L	
Rajah Oil & Ref. Co., Youngstown	500		S	
Total	2,000			

OKLAHOMA

Associated Petroleum Co., Allen	8,000		S-C	Jenkins
Canfield Oil Co., Yale	400		S-L	
Carter Oil Co., Cartoco	5,000		S	
Century Pet. Co., Tulsa	2,000		S	
Chestnut & Smith Corp., Sand Springs	5,000		S	
Continental Oil Co., Sapulpa	4,000		S-C	Cross
Empire Oil & Ref. Co., Cushing	5,000		S-C	Doherty
Gem Refining Co., Oklahoma City	1,000		S	
Gilmer Oil Co., Ringling	1,000		S	
Globe Oil & Ref. Co., Cushing	2,500		C	Jenkins
Huckins Ref. Co., Earlsboro	1,500		S	
Illinois Oil Co., Cushing	3,000		S-C	Donnelly
Imperial Ref. Co., Ardmore	4,000		S-C	Dubbs
Interocean Oil Co., Bristow	3,000		S	
Morgan Pet. Co., Tonkawa	3,000		S	
Peppers Gasoline Co., Covington	1,000		S	
Producers & Refiners Corp., Cushing	2,500		S	
Santa Fe Oil & Ref. Co., Ardmore	5,000		S	
Superior Oil Corp., Grandfield	2,000		S	
Walters Ref. Co., Walters	2,500		S	
Total	61,400			

PENNSYLVANIA

Conewango Ref. Co., Langdale Switch	2,000		S	
Island Pet. Co., Neville Island	1,000		S-L	
North Penn Ref. Co., Tiona	500		S-L	
Pure-Penn Ref. Co., Clarendon	350		S-L	
Swan-Finch Ref. Corp., Warren	1,000		Comp.	
Titusville Oil Works, Titusville	1,000		S-L-C	Titusville
Viking Oil Corp., Clarendon	2,000		S-L	
Waverly Oil Works Co., Coraopolis	3,000		S-C	Cross
Total	10,850			

TENNESSEE

Nashville Oil Co., Nashville	500		S	
Urania Pet. Co., Ltd., Memphis	500		S	
Total	1,000			

TEXAS

Company and plant location—	Crude oil cap.	Crack. cap.	Type of refinery	Type of cracking plant
American Ref. Properties, Wichita Falls	5,000		S-C	Dubbs
Atlantic, Pacific & Gulf Ref. Co., Wichita Falls	5,000		S-C	Jenkins
Bobrose Oil & Ref. Co., Brownwood	1,000		S	
Central Ref. Co., Friars Switch	10,000		S	
Crystal Oil Corp., Burkburnett	1,000		S	
East Texas Ref. Co., Longview*	5,000		S	
Ewno Oil Corp., Luling	2,500		S	
Foster & Co., Denison	600		S	
Four States Ref. Co., Texarkana	700		S	
Freeport Asphalt Co., Freeport	5,000		S-A	
Gladetex Ref. Co., Gladewater	500		S	
Golden West Oil Co., Hondo	150		L	
Great West Ref. Co., Big Spring	5,000		S	
Humble Oil & Ref. Co., McCamey	15,000		S-A-C	Tube & Tank
Humble Oil & Ref. Co., Breckenridge	1,500		S	
Humble Oil & Ref. Co., Chilton	4,500		S	
Iowa Park Prod. & Ref. Co., Iowa Park	3,000		S	
Kent Ref. Co., Minerva	2,200		S	
Magnolia Pet. Co., Magpetco	10,000		S	
Mid-Tex Ref. Co., Midland	2,500		S	
Macmillan Pet. Corp., Borger	8,000		S	
Motor Fuel Products Co., Laredo	2,000		S-C	Jenkins
Nacogdoches Ref., Inc., Nacogdoches	500		S-L	
Norgold Ref. Co., Olney	1,000		S	
Petroleum Conversion Corp., Texas City	3,000		C	T.V.P.
Petroleum Refractionating Corp., Longview	15,000		S	
Primrose Ref. Co., Wichita Falls	2,500		S	
Richardson Ref. Co., Big Spring	7,500		S-C	Jenkins
Seymour Ref. Co., Seymour	250		S	
Signal Gasoline Co., Texon	500		S	
Superior Ref. Co., Tiffin	2,000		S	
Sweetwater Oil & Ref. Co., Sweetwater	1,000		S	
Texas Mexican Oil & Ref. Co., Laredo	1,000		S	
Tonkawa Pet. Co., Pyote	4,000		S	
V. O. E. Ref. Co., Gladewater	500		S	
Western Oil Corp., Burkburnett	3,000		S	
Young Ref. Co., Archer City	250		S	
Total	132,150			

*Also known as Henderson Refining Co.

UTAH

Diamond Oil Co., Virgin	250		S	
Jenson Oil Ref. Co., Ogden	1,000		S	
Total	1,250			

WASHINGTON

Inland Empire Ref. Co., Parkwater	500		S	
Spokane Oil & Ref. Co., Hillyard	1,000		S	
Total	1,500			

WYOMING

Alliance Oil & Ref. Co., Thermopolis	1,500		S	
Eclipse Oil & Ref. Co., Newcastle	40		S	
Lovell Ref. Co., Lovell	600		S	
Standard Oil Co. (Indiana), Laramie	2,500		S-C	Burton
The Texas Company, Cody	3,000		S-C	Holmes-Manley
Total	7,640			

Explains Analysis and Control of Water Supply at Baytown Refinery of Humble Company

By P. ALBERT WASHER
Humble Oil & Refining Co.

The field of hydraulics is great in its scope and diverse in its application. Especially is this true if such branches as hydrology and hydrodynamics are taken into consideration. It is obvious that in an oil refinery where water assumes an importance secondary only to the oil itself that many problems are encountered. The specific extraction of the water to its final point of utilization affords many opportunities for conserving the supply, improving operations, and effecting economies in general. In this article are cited various cases in the realm of hydraulics noted in actual observations. The different solutions used in coping with each type of problem are also presented. Although the subject matter for this article has been compiled from data obtained at the Baytown refinery of the Humble Oil & Refining Co. and the surrounding region, it is felt that the case dealt with is typical enough to be of general interest so that the results of the work may be helpful in dealing with other similar situations.

The Baytown refinery of the Humble Oil & Refining Co. is located in Baytown, Harris County, Texas, about 28 miles east of Houston. Part of the refinery site borders on the Houston Ship Channel. The accessibility to this body of water might appear advantageous as a source of supply for nearly all refinery operations. However, this is not the case, as the presence of large amounts of sodium chloride and other undesirable chemicals prohibits its delivery to most units. The use of the channel water is, therefore, restricted to open condensers. In view of these objections, it has been necessary to develop a water supply low in mineral content for industrial and domestic purposes and of a satisfactory temperature for cooling needs. Before presenting the details of systematic development, a brief resume of conditions up to the year 1928 is given.

Prior to this time, no great attention was paid to the water situation. Operations were progressing at a normal rate and there was apparently sufficient water available to meet the demands. But in 1928 rapid expansion in operations commenced. Information was obtained concerning the amount of water necessary to furnish present and future needs. Charts were constructed to observe the trend of consumption. The slope showed that the water to be supplied from the fresh water system would be increased about 3,800 g.p.m. per year. So great was this additional amount that a survey was conducted to determine the status of each consumer concerning water utilization. Inquiries were made concerning such information as the amount, temperature and pressure of the water required and the purpose for which it is used. Also, other phases of the water situation, as the type of water wells in use and the geology and hydrology of the region were carefully investigated. Since the greatest interest of the problem arises from the unusual geological and hydrological conditions in this area, a brief description of these features is given here.

General Geology and Hydrology

The Baytown area is a part of the low relief Gulf Coastal Plain which lies a little above sea level and in this region extends from Oklahoma to the Gulf of Mexico. The area is bounded on the east by the Trinity River and on the west by the Brazos River and is crossed by a number of rivers and perennial creeks. From the foot of the most prominent escarpment, the Hockley, to Baytown, a distance of less than 60 miles, there is a fall of only about 150 feet.

TABLE 1—HOUSTON-BAYTOWN-GALVESTON AREA*

System—	Series	Formation	Thickness (feet)
Quaternary	Recent	Stream and beach deposited sand, gravel, clay and shells	0–25
	Pleistocene	Beaumont clay	1,300
		Lissie formation	600–750
	Pliocene	Reynosa formation	600–800
Tertiary	Pliocene		
	Miocene	Lagarto clay	1,000–1,400

*From U.S.G.S. Report, released October 17, 1932.

TABLE 2—MERITS OF STRAIGHT AND GRAVEL WALL TYPE WELLS

Straight type	Gravel wall type
1. Screen opening must be fine enough to hold back sand.	1. Screen openings are large as they only need to hold back the gravel.
2. Clog quickly.	2. Will not clog.
3. Friction in sand and fine screen causes small production.	3. Gravel and large screen openings permit free flow of water into well.
4. Only a small quantity of water can enter well. If more is pumped, the increased velocity will carry fine sand through the screen, cut it out and destroy it.	4. Large quantity of water safely enters well. The velocity when leaving the sand is so low that it does not move the finest particles.
5. Drawdown is large compared with the number of gallons pumped.	5. Drawdown is small compared with the number of gallons pumped.
6. The metal is the screen.	6. The gravel is the screen.

See Chart 1 for construction.

The shallower sediments range in age from the Miocene to Recent and have a total thickness of 2,500 to 4,000 feet and outcrops to the north. They were deposited, for the most part, under water during successive advances and retreats of the sea. The sand and gravel were deposited close to the shore; and the mud and clay were laid down in deeper water. Movement of the sea inland caused zones of deposition to move with it, and, hence, almost continuous deposits of sand, partly overlain by clay, reach to the outcrops from this locality and others farther seaward. The beds have been modified materially as a result of reworking when the land was above water.

A generalized section of the geologic formations that crop out in this area is given in Table 1.

Supplies of ground water at and near Baytown occur in formations of the Pleistocene series. The beds consist of relatively impermeable clay, gumbo and shale, interbedded with layers of permeable sand. The sands tend to pinch out toward the southeast, and the beds of clay predominate over large areas. Towards the northwest, the clays seem to appear more as lenses while the beds are dominantly sandy. The approximate depths of the two principal zones at Baytown are from 300-500 feet and 700 to 1,000 feet. Below 1,000 feet strata are encountered that are quite prolific in salt water. In fact, one well, No. 18, drilled to 1,686 feet, flowed when it was drilled in 1928. There are several strata above 300 feet that do not yield much water. One of these, approximately 50 feet below sea level, shows considerable variation in chloride content, some places being very high and in others not much greater than the water from the 700-900-foot sands.

The extensive outcrops of the different formations form catchment basins from which Baytown and other cities draw their artesian supply. The predominating soils on these areas are fine sandy loam and clay loams supporting luxuriant growths of grass and shrubbery. The streams in their gulfward course cross one outcrop after another and undoubtedly lose a part of their water by seepage into the permeable sands, except where these sands are sealed by dense deposits of clays, etc. Replenishment of the permeable sands is accomplished principally by the rain falling on the outcrop areas.

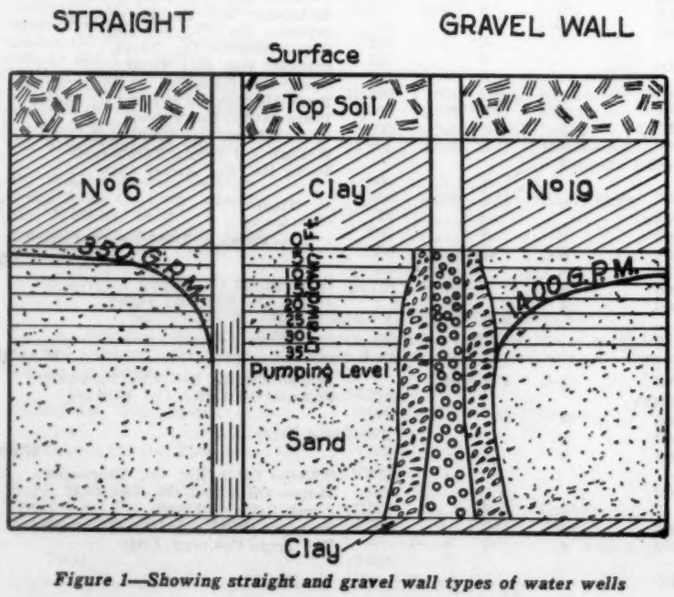


Figure 1—Showing straight and gravel wall types of water wells

The climate of the entire region is humid and heavy rains are of frequent occurrence. The records of the U. S. Weather Bureau show an average rainfall of 47.05 inches during 47 years for Houston; 48.28 inches at Conroe, 40 miles north of Houston, during a 14-year period; at Hempstead, about 50 miles northwest of Houston, during 30 years, 41.04 inches. With such a high average rainfall, the recharge is bound to be considerable. Studies of the penetration on these outcrop areas are in progress by the U. S. Geological Survey. In four localities pits have been sunk and lysimeters installed in tunnels driven laterally from them. They state, so far, that the experiments with these instruments have only partly been successful, but indicate that water in the perched zone (a zone temporarily built up in late fall and winter due to small amount of evaporation and transpiration losses) moves downward in considerable depths exceeding 10 feet below the surface. At such depths the water is below the zone of evaporation and out of the reach of the grass roots and, if not intercepted by deeply seated tree roots, it must move downward to the water table.

The discharge of the ground water occurs through evaporation from the soil, transpiration from the plants and hygroscopic losses on the outcrop areas. Flow of springs and movement down the dip of the beds to unknown outlets, possibly located beneath the Gulf, add to the further dissipation of the recharge. Withdrawals from wells in Baytown, Houston and Alta Loma constitute the greatest source of depletion. The velocity of the water through the sands is exceedingly slow but is increased considerably in the neighborhood of a pumping well. Based on such formulae as the Slichter, D'Arcy, and others, the velocity is computed to be less than 0.4 feet per day (using $S = 0.00212$). The speed of the water depends on several factors and in the vicinity of operating wells is, to a great extent, a function of the type of well.

Description of the Wells

Nineteen wells have been drilled for the company. Up to 1928, eight of these had been abandoned for various reasons. Of the remaining 11 wells shown in Figure 2, nine have been producing fresh water, one salt water, and the other is used as an observation well. The wells vary from 6 to 18 inches in diameter and 500 to 1,000 feet in depth, save the salt water well, which is 1,686 feet deep. The production ranges from 800 g.p.m. to 2,000 g.p.m. Several of the wells (Nos. 4, 6 and 18) are of the straight type and the others are of the gravel wall type. The difference in construction should be noted as the merits of the gravel wall type have been capitalized to advantage in the equalized extraction plan.

Three of the wells, Nos. 4, 6 and 10, constitute the domestic system. A high discharge pressure of about 50 pounds per square inch is maintained on the domestic line. At present, most of the water is used for domestic purposes. Before the institution of the systematic extraction and utilization plan, however, some of this water was used at gas plants, boiler houses, and other industrial locations. As related later, cer-

tain substitutions were made in water utilization after the general survey had been completed. Invariably, there is an excess quantity of water from the domestic main that flows into the gathering line of the other wells. This amount is controlled by a regulating valve and is dependent upon the observed pressure on the domestic system. Obviously, higher costs are met with in operating one of these wells because of high discharge pressures. Also the greater the surface operating head, the more rapid is pump deterioration.

The other system in use at Baytown is the industrial system. The wells that comprise this group are Nos. 7, 9, 12, 13 and 19. The discharge head maintained on these wells is enough to overcome friction loss due to line resistance and head lost in overcoming elevation. This usually averages about 8 pounds per square inch. The water from these wells is pumped directly into a reservoir of approximately 15,000,000 gallons capacity. From this source the water flows by gravity through a 42-inch concrete main to a pumping site located near the center of industrial consumption. The pumps take suction on the water at this point and boost it to 65 pounds. The greater part of the industrial water serves as make-up for different cooling systems; a considerable amount is used in steam generation, first being softened by treating; and the remainder is used in various refinery processes.

Well No. 18 is 1,686 feet deep and has been producing from 1,500 to 2,000 gallons per minute of salt water, varying with the discharge pressure. The average surface head maintained on this well is about 70 pounds per square inch. Since this water is used in the acid treaters for washing, the demand fluctuates due to intermittent operations. At times the pressure on the pump has been as high as 125 pounds per square inch. To eliminate this condition a regulating valve was installed in a separate line from the well to certain open condensers. When the pressure on the pump reaches 75 pounds, the water releases into the condensers.

Well No. 1 has been selected as the main observation well to study the effects of such influences as hydrostatic pressure variations, tides, temperature and barometer. To assist in these investigations, a Gurley recording gauge has been installed in the well. When surrounding wells are shut down the charts from the Gurley gauge can be interpreted as though the well were in virgin territory, i.e., the level in the well is not depressed by a nearby well.

The wells are all pumped by vertical centrifugal pumps. These vary in size, having from two to nine stages. The staging is naturally a function of the head and capacity. All pumps are equipped with the thrust bearing to carry the weight of the shaft and pump impellers and also the hydraulic downthrust of the pump due to the column of water being lifted. Each pump contains one radial bearing to steady the shaft. So important is the thrust bearing that the pump is classified according to whether it is of the ball thrust or tilting segment type. The selfaligning ball type consists of a single row of balls between an upper and lower race plate. This is used on pumps of medium capacity operating against a low head. The tilting segment type of bearing consists of a flat upper plate resting on a lower plate cut into segments mounted to allow a slight tilt. This type is now used exclusively on pumps at Baytown. Motors ranging from 100 to 350 horsepower are used on the pumps.

It can be seen from the characteristic curves of Well No. 19 (Figure 3) that the best method of operating a vertical centrifugal pump is at a point just beyond that of maximum efficiency, so that a slight decrease in well output does not decrease the efficiency. The point of maximum efficiency is termed the "design head."

It is obvious, then, that the efficiency of a pump can be controlled by throttling of the discharge, by level variations and other methods. These facts, together with the information ascertained in the general survey revealed that a certain balance or equalization could be made between the different forms of operation to increase efficiency, prolong well life and maintain production. This led to the formulation of "the equalization policy."

Equalization Policy

The equalization policy is the balancing of water utilization with extraction by a systematic procedure. The policy had its origin from the First Law of Thermodynamics: "When work is transformed into heat or heat into work, the quantity of work is mechanically equivalent to the quantity of heat." The loss of power by throttling of pumps, the potential pressures in wells of high static head, the dissipation of power into friction loss in straight wells and those of large cone areas are converted to a common work basis. Comparisons are made as to the advantages of one set of conditions compared to those of another. The most economical operation is usually followed. The different plans naturally involve different pumping schedules. Some wells are idled and others are kept in operation. Since such conditions as mineral content, temperatures, levels, etc., vary for the different wells, the wells that are pumped are governed by the greatest number of inherent advantages. As the static heads are dependent upon the amount of water flowing into the strata at Baytown, the safe extraction quantity, without causing a severe drop in level, can only be determined by calculating the inflow.

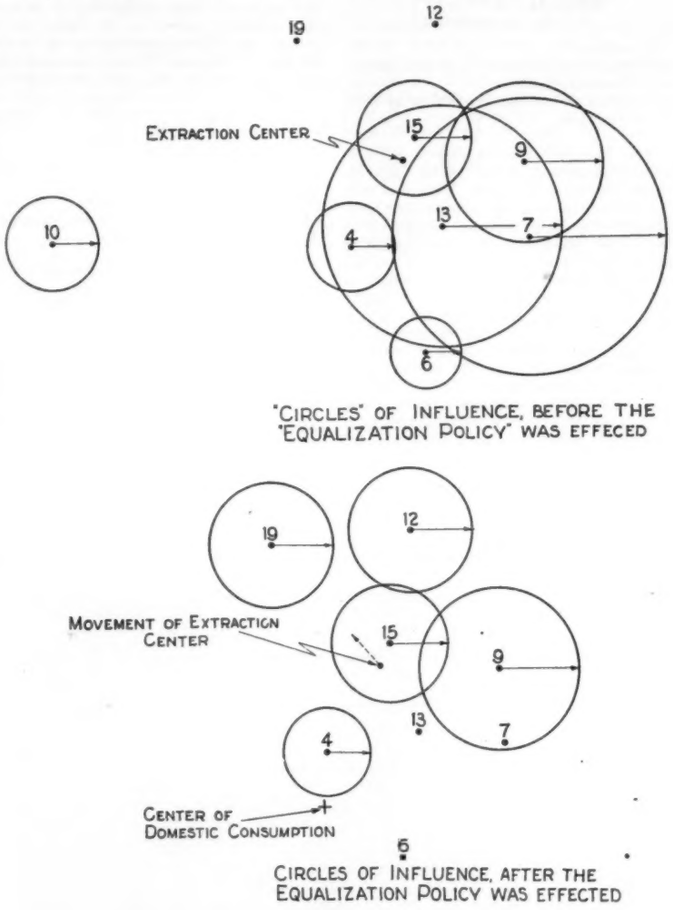


Figure 2—Benefits of distributing pull on water wells

Calculation of Inflow

The amount of inflow to any part of the area depends on the permeability and thickness of the water-bearing formations and the average hydraulic gradient. The coefficient of permeability can be expressed as the number of gallons of water that will flow daily through a cross section of the water-bearing bed 1 foot high and 1 mile wide for each foot of head per mile. The total flow across a segment of the formation 1 mile wide is obtained by multiplying the coefficient of permeability by the thickness of the formation and this product by the hydraulic gradient. That is,

$$Q = P \times t \times S \times 2\pi R$$

In which:

Q = Gallons of water flowing daily.
P = Coefficient of hydraulic permeability.
t = Thickness of sand (in feet) supplying wells.
s = Average hydraulic gradient.
R = Radius of "Hypothetical R" in miles or a definite contour taken on artesian pressure head map. (See under "Circles of Influence.")

Since there has been much controversy concerning the methods of computing the inflow, it is interesting to note just how the factors in the formula stated above have been determined. The coefficient of hydraulic permeability, "P," was obtained by application of the well-known Thiem's formula:

$$P = \frac{527.713q \operatorname{Log} \frac{a^1}{a}}{m(s - s^1)}$$

In which:

P = The coefficient of permeability.
q = Rate of pumping in gallons per minute.
a and a^1 = Respective distances of the two observation wells from the pumped well in feet.
m (for artesian conditions) = Thickness of water-bearing bed in feet.
s and s^1 = Drawdowns at the two observation wells in feet.

In one case, well No. 4 was operated while Nos. 1 and 6 were used as the servation wells. As a rule, however, No. 7 is used and Nos. 13 and 15 (or 19) are used as observation wells. The necessity for operating most of the wells continuously has prevented much research on this phase. From a digest of the data that has been obtained, and calculations with the above formula, a coefficient of 175 has been employed for work at Baytown.

The thickness, t, was obtained by studying the logs of the wells in the refinery. The radius, R, is obtained as described later under "Circles of Influence." Substituting a contour line for this R gives larger results. It should be mentioned at this point that the water moves at right angles to the contours along the strike and up the dip of the water-bearing formations as well as down the dip.

The hydraulic gradient, s, has been the subject of much debate. This is due to the fact that there is a "natural" gradient and a gradient created by the well being in operation. The formula for the former is:

$$s = \frac{h}{L}$$

In which:

h = Total head acting on water, feet.
L = Distance through which water flows, miles.

The gradient used throughout this report has been termed the average hydraulic gradient (composite) and has been determined by solving the following:

$$s = \frac{Pv}{3.3sd^2}$$

Where:

s = Hydraulic gradient.
v = Average actual velocity through pores of the sand in feet/day.
d = "Effective size" of sand in millimeters.
P = Porosity ratio. Porosity will vary ordinarily from about 40 per cent for a fairly uniform bank sand to 30 per cent or less for a very compact sand or one of a low degree of uniformity (uniformity coefficient of 6 or more).
A constant. The term $\frac{c}{P}$, representing the effect of porosity or compactness of the material on the velocity, may be roughly estimated from Hazen's experiments at about 1,000/.40 = 2,500, for P = 40% to 400/.30 = 1,330 for P = 30%. This is in general agreement with Slichter's results, namely, that velocity of flow for materials of a given size is approximately proportional to the square of the porosity ratio.

In ascertaining the "effective size," d, actual sand samples were baked and screened. The effective size was then computed from the definition: This size is such that 10 per cent of the material is of smaller grains and 90 per cent is of larger grains than the given size. This was found to be 0.17 millimeters.

To get the porosity, p, the total volume of the sample was first obtained and then the aggregate of the grains was determined. The porosity is then computed by substituting in:

$$P = \frac{100\,V - v}{v}$$

In which:

P = Is the porosity in percentage.
V = Volume in sample.
v = Aggregate volume of the grains.

The porosity was found to be 37 per cent but because of errors that arise in packing, a 33 per cent porosity has been used. The evaluation of the velocity, v, is open for question. However, several different methods were used to arrive at a tentative figure. The velocity was checked first by computing in square feet the area of sand cross section based on

the total average radii of influence (R) and dividing this result into the cubic feet of water being pumped from the wells. This gave a velocity of 0.372 feet per day. Slichter's and Lueger's methods gave lower results, while the Hazen formula checked fairly well.

$$Q = \frac{2012sd^2A}{uk} \quad \text{Slichter}$$

$$V_s = 288ds \quad \text{Lueger}$$

$$V = \frac{cd^2h(t[^\circ F.] + 10^\circ)}{60^\circ} \times \frac{1}{P} \quad \text{Hazen}$$

Another method has been devised to check the inflow. However, since all are somewhat theoretical and subject to error, it has been customary to check the levels in the wells periodically. To quote the U. S. Geological Survey: "If an underground reservoir is heavily pumped, a study of the relations of the water levels in the wells to the amount of pumpage is likely to give more reliable information as to the safe yield that can be obtained by any other method."

It is necessary to check the levels in all wells semiannually as the observation well (No. 1) is the criterion for the "700" foot stratum only. A study of the past meteorological conditions has led to the practice of checking the wells in April and October. It is usually customary to observe the static heads after a well has been idle for some time—the longer idle the more accurate the results. For all wells, save well No. 1, the levels are checked by a pipe extending into the well below the water surface. Air is pumped into the pipe to displace the water. From a reading of the manometer on the line, the depth that the pipe extends into the water can be obtained. Since the length of the pipe is known, the height of the water in the well is easily figured. The levels are also determined during the operation of the well. The difference between the operating or full flow level and the static head is called the drawdown. To facilitate the interpretation of reports, certain letters have been selected to designate the status of the levels.

A high level, H, indicates that the water entering the cone area tributary to a well is exceeding the amount extracted. Pumps in these wells operate under a flooded suction. Economical pumpage, good operations, and water low in mineral content are invariably the results of such levels.

A normal level, N, points to fairly equilibrium conditions, i.e., pumpage is not greater than extraction. Conditions are satisfactory.

A low level, L, denotes excessive extraction compared to inflow, or a reduction in specific capacity resulting in a greater drawdown. When the level drops the cost of extraction increases, the pump frequently loses suction, production is decreased and interference becomes greater. Persistent extraction from areas in which the static head is continually dropping necessitates deeper pump settings and, in some cases, might ruin an entire supply.

The levels are checked during the period that a well is idle and also when it is operating at full capacity. As it is necessary to be very accurate in obtaining the level at a specified flow, the meter is checked by a manometer across the venturi throat. In some cases, an orifice piezometer or weir is used as a check. The formula for each case is given below:

$$Q = \frac{c\sqrt{h}}{60 \times 24}$$

General flow, in which:
Q = Quantity of liquid passing through throat, usually expressed in gallons per minute.
h = Differential pressure in inches of water.
c = Hourly coefficient; obtained from:

$$C = \frac{324d^2}{\sqrt{1 - x^4}}$$

In which:
d = Diameter of throat in inches.
x = Ratio of throat diameter to pipe diameter.

$$Q = KA\sqrt{2RH}$$

Orifice piezometer, in which:
Q = Quantity in gallons per minute.
A = Area of orifice in square inches.
H = Height of water in glass above center of pipe in inches.

$$R = \frac{\text{Diameter of orifice}}{\text{Diameter of pipe}}$$

K = A constant.

Weirs Formula

$$3.33bh^{3/2}$$

Suppressed; no velocity of approach.

$$3.33b[(H + h)^{3/2} - h^{3/2}]$$

Velocity of approach.

In which:
Q = Discharge in cubic feet per second.
b = Breadth of notch.
H = Head above crest, measured by hook gauges.

The flow at each particular level is plotted as shown on the depth capacity chart (Figure 5). A clear picture of any change in the well or its pumping conditions is quickly revealed by observing for slope variations or the breaking point. However, it is customary to calculate the specific capacity, S_c, which is the index of a well's condition. It might be likened to the H_o (overall heat transfer coefficient) of a heat exchanger. A low H_o means constriction in a heat exchanger while a high H_o means clear passages. A low S_c invariably means restricted water entry into a well, while a high S_c points to a satisfactory flow rate. The method of calculation is simple:

$$S_c = \frac{H - h}{Q}$$

In which:
H = Pumping head at full load.
h = Static head.
Q = Gallons per minute at full load.
S_c = Specific capacity, gallons per minute per foot drawdown.

Accurate knowledge of the specific capacity is necessary in the solutions of different problems. Even the pump staging, length of discharge column, shafting, etc., are functions of this important criterion. Failure to know a well's specific capacity might result in much unnecessary expense and possible harm. These factors are, therefore, checked carefully at each test period to observe any variation. If the factor has been reduced, the cause is traced and methods adopted to improve the flow. However, it is the aim of the equalization policy to prevent or minimize these reductions.

The next important data obtained in the tests are those pertaining to pumps. The specific speed is the index of a pump's operation, particularly as to the amount of staging. This is computed by knowing the flow at a definite speed.

$$N_s = N \times \frac{\sqrt{Q}}{H^{3/4}}$$

In which:
N_s = Specific speed.
N = Revolutions per minute.
Q = Cubic feet per section per second.
H = Feethead.

In actual experience, it has been observed that the greater the specific speed, the greater is the pump's efficiency if the head per stage is low. In addition to the specific speed, characteristic curves are also plotted. These are computed from data obtained by throttling the pumps to different flows. Such data as power input, discharge pressure, and total underground head (column friction plus drawdown plus static head) are obtained.

From a digest of the specific speed and characteristic curves, the pumps are segregated into classes, termed "A," "B," and "C." Those of the "A" class are new pumps. The pumps of the "B" class show satisfactory operation. Those needing inspection or repairs are relegated to the "C" group. The classification of the pumps has its part in the functioning of the equalization policy.

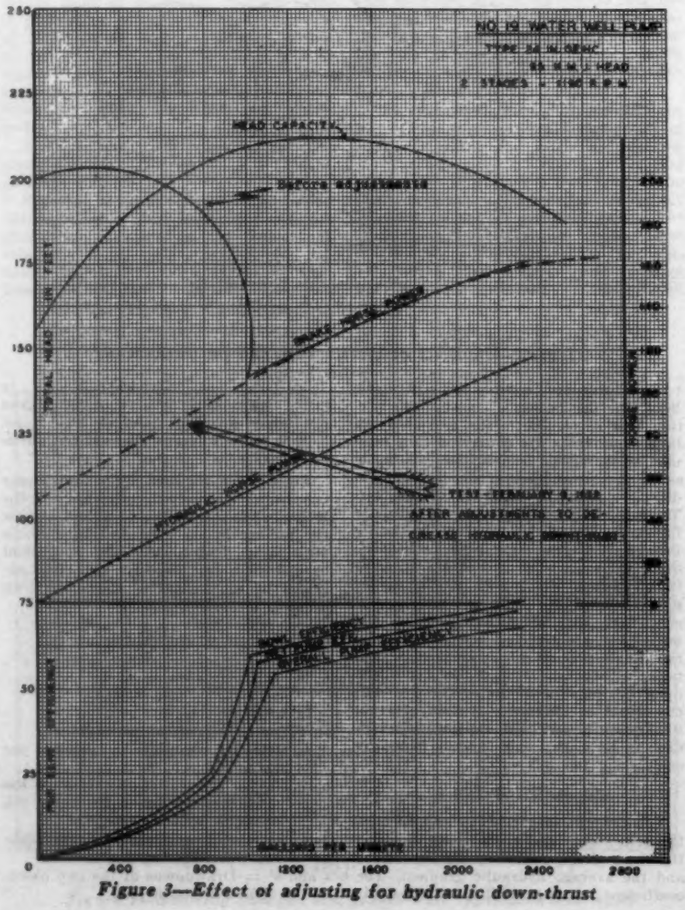


Figure 3—Effect of adjusting for hydraulic down-thrust

The temperature of the wells is noted during the test periods as these vary from time to time. The reasons for these changes as well as differences in temperatures may be traced to the fact that the temperature of the ground and hence, of underground water increases 1° F. for every 60-100 feet descent. Some of the wells have screens set at practically all sands. These wells naturally receive a "blended" water. The other wells (shallow) take water from the upper strata only. If the shallow wells are pumped heavily, the wells open to all strata receive less volumes of water from the upper sands. This increases the ratio of the deeper water. Since the deeper water is the warmer, the water issuing from these wells will be of a higher temperature. If the draft is exerted on the lower strata, then the contrary effect is produced. It has been noted that there are variations as high as 15° F. in temperatures.

The analysis of each particular well for a change in mineral content is essentially part of the observation data. Differences in concentrations are caused by several factors. Chief among these is the variation in the amount of water produced from the different strata. Invariably the shallow strata produce water low in minerals while the deeper strata furnish water with a greater amount of minerals. The mineral content is then a function of changing ratios.

One reason for a water being soft, hard, or brackish might be of interest to mention. Water, in its underground travel, leaches out certain beds or deposits. In one location it may leach out calcite deposits; in another formation it may filter through saline beds. The water would then be affected by its movement.

Lowering of the water table sometimes increases the chloride content. In some coastal regions the ocean has invaded the wells, spelling disaster to the entire supply. (This is a subject of investigation in this area.)

Another important and, perhaps, dangerous source of mineral change can be traced to leakages from one stratum to another. The water in the various sands or lenses differs in hydrostatic pressure. In fact, this is so great in the deeper sands (below 1,000 feet) that the water in the salt well during October, 1931, rose 20 feet above sea level. It is obvious that if well casing corrodes, or collapses by cave-ins, the water will flow from the higher pressure sands to those lower in pressure. This happened in one of the refinery wells. If the foreign water is high in salinity, the fresh water would become brackish; if the stray water contains such chemicals as calcite, etc., the specific capacity of the well would undoubtedly be reduced. This would be caused by the increase in sand size brought about by cementation or incrustation.

Interference

Along with other facts obtained in well testing, and of equal importance, is the interference of wells. It should be recalled at this point that for slow velocities, flow is directly proportional to the hydraulic gradient and that in the neighborhood of a pumped well this gradient is increased when the pump is in operation from a few feet per mile to, perhaps, the same number of feet per yard, and as the gradient is increased the yield is increased. If a series of test holes are dug at different distances from a drainage well and the levels checked by a series of piezometer tubes during the operation of the drainage well, the piezometric surface rises indefinitely as the distance from the well increases. The water flowing toward the well will pass through concentric cylindrical surfaces in the water-bearing strata having areas of $2\pi Dr$ (D = strata thickness; r = radius of the well). The solids thus pro-

duced by pumping wells are called cones of depression. If orthographic projections are made of these geometrical figures on a horizontal plane, the projections are observed to be a series of concentric circles.

The intersection of these cones is called interference and the greater the intersection the greater is interference. If there is, however, a general flow of ground water, a well will be lowered only until the circle of influence has broadened out far enough to cause to be tributary to the well an area in which the flow of water is equal to the pumpage. Hence, high levels decrease interference, while low levels exert the contrary effect. Such subsurface conditions as faults, fissures, reversals, affect the cone of influence.

The principal formula used in the calculation of the circles of influence is the Turneaure:

$$\frac{1.36(H-h)}{S\,\text{Log}_{10}\frac{R}{r}}$$

In which:

H — h = Drawdown in feet.
R = Radius of circle in feet.
r = Radius of well in feet.
S = Hydraulic gradient.

A formula devised for this region is used as a check:

$$R = \frac{\text{G.P.M.}}{D-P} \times K$$

In which:

G.P.M. = Gallons per minute.
D = Depth of well.
K = Constant, depending upon such factors as porosity, size of grains, etc.

Or, the net area tributary to each well will be:

$$2\pi RD\left(\frac{360 - 2\cos^{-1}\frac{R^1}{R}}{360}\right)$$

Other Data

For calculating friction loss in the discharge columns and gathering lines and other problems of this nature, the well-known Fanning formula has frequent application:

$$\Delta p = \frac{2fLeu^2}{gd} \qquad f = \frac{DuS}{z}$$

Where:

f = Friction factor, no units.
L = Length of straight pipe in feet plus equivalent length due to bends, valves, etc.
e = Fluid density in lbs. per cu. ft. 62.3 × (s).
u = Average velocity of the fluid in ft. per sec. Discharge as cu. ft. per sec. / Cross section in sq. ft.
g = 32.2 feet per sec. per sec.
d = Actual inside diameter in feet.
Δp = Pressure drop in lbs. per sq. ft.
D = Actual inside diameter in inches.
s = Specific gravity, no units.
z = Viscosity relative to water at 60° F. (Centipoises).

Sanding Data

The cause and detection of sanding is usually difficult to ascertain because of subsurface conditions. In some cases sanding is due to leakage through broken screens or corroded casing; in other cases it might enter the well through the back pressure valve or casing lap. The pumping of the sand not only causes rapid deterioration of the pump, but increases the hydraulic downthrust due to the increased density of the water. This in itself might cause a strain on the bearing or result in the impellers dragging. Each well is, therefore, checked carefully for the amount of sand being pumped.

This is calculated as follows:

$$K + S_1 + I_1 = Hd$$

Where:

K = Constant worked out for the different pumps.
S_1 = Shafting weight.
I_1 = Impeller weight.
Hd = Hydraulic downthrust in pounds.

The first important result of systematic extraction and utilization (equalization policy) has been considerable reduction in power consumption. In Table 3 are shown the amounts of water pumped and power consumed before and after systematic pumping started:

TABLE 3—PUMP DATA

Date—	Total fresh water, gallons	Power consumed, K.W.H.	K.W.H. per 1,000 gals.
May-November, 1930	2,099,000,000	2,655,000	*1.27
November, 1930-May, 1931	1,722,000,000	2,078,000	*1.21
May-November, 1931	2,030,768,000	2,005,660	†0.98

*Before. †After.

Not only was power consumption reduced about 30 per cent in extraction, but it is estimated that at least 2,000,000 k.w.h. were saved in utilization. The methods employed in effecting this decrease are discussed in detail.

Prior to the inception of the systematic pumping plan, all domestic wells were in constant operation. This naturally resulted in high power consumption due to the high discharge pressures maintained on them. However, after the unit survey was completed certain substitutions were made in the use of water. As for example, units that could replace domestic water with industrial were requested to do so. In this way the demands of the domestic group were minimized. Consequently, this left a considerable portion to flow into the industrial line. Such a procedure was obviously a waste of power as the industrial water was boosted. The logical method to correct this condition was naturally idling one or more domestic wells. The one to be kept in service was to be the most economical one. To ascertain this fact meant a study of friction loss and entailed calculating the center of gravity of the group.

The center of domestic consumption was found to be near well No. 4 (Figure 2). Clearly then, the most economical procedure was to keep well No. 4 in operation and idle one, if not both of the others. It was pointed out previously that the equalization policy was to profit by well construction, that is, wherever it was possible to idle a straight well to do so in order to lower extraction costs. Since rate of flow through granular materials is directly proportional to the water surface incident to pumping, a straight well increases the surface depression and with increased pulldown uses greater power consumption. It is one of the tenets of the equalization policy that straight wells should be pumped only in periods of high levels so that power saved by decreased suction lifts would offset that lost by friction in the well. Since well No. 6 required a 300 per cent greater pulldown for the same production than well No. 4, this was idled first. This was done, and it was noted that there was still too much water flowing into the industrial main. Well No. 10 then became the target for idling.

Before well No. 10 was shut down, theoretical calculations were necessary to prove that well No. 4 could deliver the water to well No. 10 area under satisfactory pressures. It was doubtful if well No. 4 could furnish desirable terminal pressures because of its distance from well No. 10 and the small size of the discharge (8-inch). Further, the surface head maintained on well No. 10 was about 80 pounds per square inch and that maintained on well No. 4 was but 45 pounds per square inch. However, computations based on the Fanning formula revealed certain facts that were apparently overlooked.

In the first place, the amount of water used by the units near well No. 10 was small, averaging about 300 g.p.m., or 30 per cent of the well's capacity at the normal drawdown. The remaining 70 per cent was, therefore, delivered to the refinery area through the 8-inch discharge. It is evident that by pumping the water from well No. 4 to the units near well No. 10 the flow through the main would be reduced 50 per cent. Since the pressure drop increases as the square of the velocity, the friction head would be cut to one-fourth its former value. This amounted to approximately 13 pounds per square inch.

A second factor to take into consideration was the difference in elevation of the two wells. The elevation of well No. 4 is 30.44 feet above sea level and that of well No. 10 is 12.16 feet above sea level. The head to be gained by elevation difference is then about 8 pounds per square inch. Therefore, the total head to be gained by furnishing the water from well No. 4 was about 20(13+8+8) pounds per square inch. Accordingly, well No. 10 was taken off the line. The terminal pressures were good and well No. 10 has been idle since, save for emergencies (low levels, pump repairs, etc).

It is interesting to note the economies realized by idling wells Nos. 6 and 10. The actual cost of operating well No. 10 had been around 2.06 k.w.h. per 1,000 gallons and of well No. 6 about 2.50 k.w.h. per 1,000 gallons. The cost of pumping water from the industrial wells was about 0.99 k.w.h. per 1,000 gallons. The saving effected by idling well No. 10 was 1.07 k.w.h. per 1,000 gallons, while that effected by idling well No. 6 was 1.51 k.w.h. per 1,000 gallons.

There was also another source of power reduction by idling wells Nos. 6 and 10. This was the elimination of the back pressure exerted on well No. 4 by the other two. This has decreased the pulldown so that No. 4 pump could not operate at or near its "design-head." When the back pressure had been released the pump operated at its "design-head." Extraction cost from this well dropped from 1.78 k.w.h. per 1,000 gallons to 1.41 k.w.h. per 1,000 gallons.

After having placed the domestic system on an economical basis, attention was focused on the industrial system. Consideration was given to the advantages of pumping different wells, especially wells Nos. 12 and 19, which had been shut down the greater part of the time due to their outlying distances, while other wells were kept in constant operation. (Figure 2.) The situation was carefully studied and the circles of influence calculated for each well. Well No. 7 was observed to be encroaching not only on well No. 9 but on others. Since the cones of influence are subject to error due to subsurface abnormalities, the theoretical data were checked in actual field work. This was done by noting the static head of well No. 9 while well No. 7 was idle, and then operating well No. 7 to note the depression in well No. 9. There was a difference of over 10 feet. The same procedure was followed with other wells and it was proven that well No. 7 was the worst offender.

There were then two solutions to remedy this condition. The first was to throttle well No. 7 to such a flow that interference would be minimized. However, such a procedure would have proven costly, because the pump would have operated far from its "design-head," and hence with a lower efficiency.

The second solution was to idle the

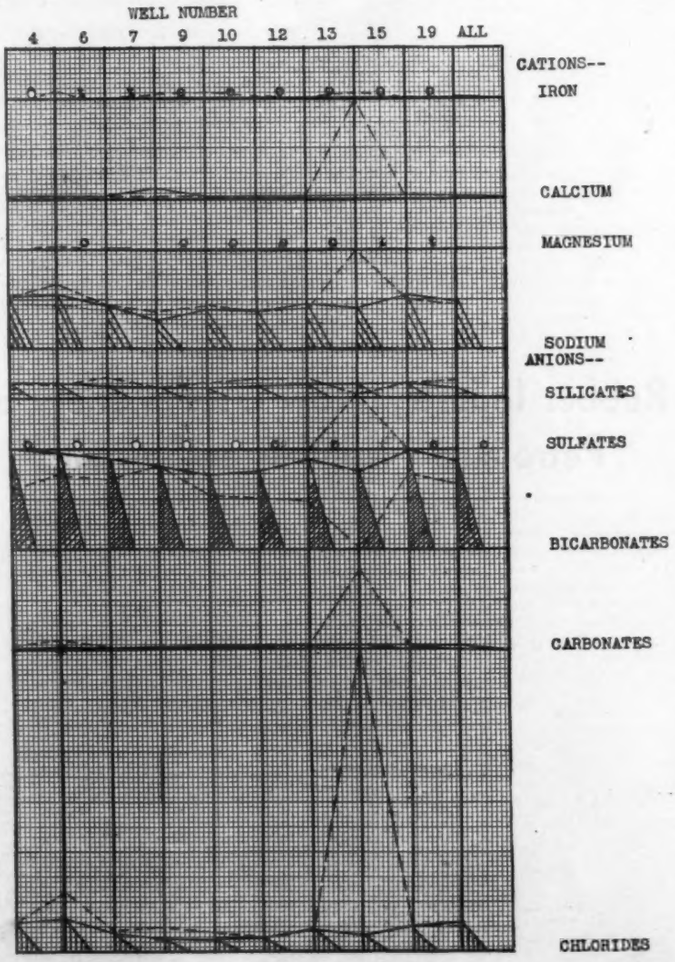


Figure 4—Detection chart. Dotted line: Mineral content for April tests; Solid line: Mineral content for October tests; Smallest division: 20 parts per million (read vertically); t : Trace

well, particularly when the level of the 500-foot stratum was low (L). Well No. 7 was, therefore, idled with gratifying results. In addition to increased production of other wells in this cone, the cost of extraction was much lower. For well No. 9 the cost had been as high as 1.38 k.w.h. per 1,000 gallons, but reached the small rate of 0.61 k.w.h. per 1,000 gallons, the lowest in the well's history. Wells Nos. 12, 13 and 15 also showed lower power consumption.

The explanation for the decreased power consumption is interesting to study. In the first place, idling well No. 7 diminished the draft on the upper strata. This allowed the static levels to rise in wells Nos. 9, 12, 13 and 15. The higher the level the cheaper is the cost of extraction. This is caused by the fact that the cost of power (except for variations in demand charges, pump and motor efficiencies and friction losses in the piping) is proportional to the total height through which the water must be lifted. This total lift is made up of the distance the water must be lifted above the static water table plus the total drawdown. The former is usually fixed by topography and effected by draft. The total drawdown is made up of the friction in the well tube between the point where the water enters the well and the entrance to the suction pipe of the pump, plus the loss of head at the perforated well casing or strainer, or the entrance head at the well tube, plus the loss of head through the water-bearing strata. Under normal conditions this is by far the largest part of the total drawdown save in straight wells. The high levels, therefore, reduced suction lifts, as well as decreased friction losses in the sand.

Another reason for lower operating expense might be attributed to minimizing interference. Pumping water against an opposing force would naturally require more power than pumping a "free" body of water. It is one of the primary aims of the equalization policy to curtail interference, particularly during periods of low levels. This is done by operating certain groups of wells. For example, one set is wells Nos. 4, 9, 12 and 13, while another combination comprises wells Nos. 4, 12, 15 and 19 (Figure 2). It should be mentioned that some interference between wells is permissible as more piping and consequent friction losses will result from the placing of the wells sufficiently far apart to avoid all interference. A study of Figure 2 shows how the wells look before and after the equalization policy was put into effect.

Mineral Content

Systematic pumping has kept down the mineral content of the water. Decreased mineral content, particularly the carbonate group, means lower cost of treating the water for high-pressure steam generation. Further, if the concentration in the boilers exceeds 3,000 p.p.m. it is often necessary to resort to hand blowdown. This procedure increases water waste and heat loss. As a rule, the alkalinity of the water is minimized by operating the lower mineral content wells, provided other conditions, as high levels, etc., are favorable. Data submitted below show the effects of operating wells high or low in mineral content.

Operation of low alkalinity wells	Operation of high alkalinity wells
Methyl orange alkalinity p.p.m.	Methyl orange alkalinity p.p.m.
313	340
302	320
296	324
293	332
292	313
286	324

Periodic analyses have enabled the detection of foreign chemicals entering wells. In April, 1931, the mineral content of well No. 15 was extremely high. A study of the detection chart (Figure 4) pointed to a leak in the casing. The pump was pulled, and it was found that a stray stream of water was seeping into the well through a hole in the casing. Sand and undesirable chemicals were entering the well, and contaminating the strata. Treating costs at the water treating plant rose sharply and abnormal amounts of blowdown were being used. New casing and pump were placed in the well and operations commenced after a long period of idling. After pumping for two months the water was again analyzed. Comparison of the two analyses indicated the well to be in good condition. The alkalinity of the fresh water showed an appreciable decrease due to a "cleanout" of the strata.

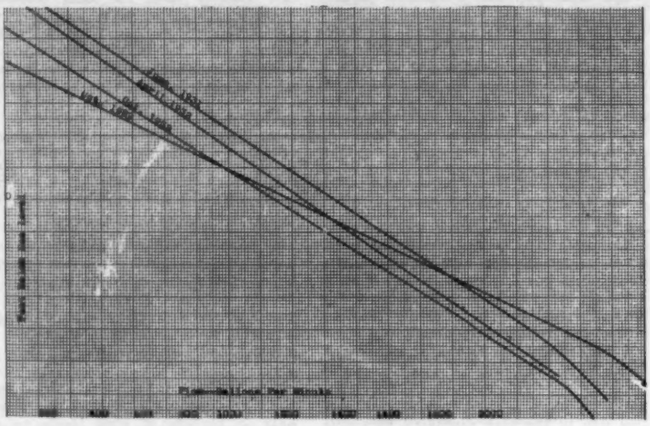


Figure 5—Depth and capacity relationship of water wells

NO 15 WATER WELL ANALYSES
(Parts per million)

	Dec., 1932	Aug., 1931
Cations		
Iron	7.00	0.00
Calcium	408.00	12.00
Magnesium	91.40	0.00
Sodium	391.80	151.10
Total	898.20	163.10
Anions		
Chlorides	1,225.00	65.70
Sulphates	224.30	0.00
Silicates	28.35	57.00
Carbonates	314.00	21.00
Bicarbonates	00.00	253.65
Total	1,791.65	427.35
pH	7.5	8.0

Cooling Benefits

Another advantage derived by the institution of systematic pumping is cooler water for summer use. It is estimated that approximately 200,000,000 B.t.u. are excluded daily from the reservoir in the hot weather when the correct wells are being operated. This is an intangible saving but would be equivalent to the operation of a cooling tower. In fact, this water is more desirable than cooling tower water because of its lower temperature. Clean, fresh water issuing from the wells around 75° F. in the summer is far preferable to recirculated water varying from 80-105° F. in temperature, because the low temperature water produces better operations and greater efficiency. This is illustrated by only one of many cases.

At one location, cooling tower water was being used for steam condensation in a series of barometric condensers. The absolute pressures increased to such a degree that it was necessary to return to the use of fresh water.

Kind of water—	Temperature °F.	Absolute pressure of condensers, inches Hg.
Fresh	78	2.4
Recirculated	94	4.2

The lower absolute pressures obtained by use of the fresh water more than compensated for the change as the throughput was materially increased.

Production

The present production is contrasted with that of February 8, 1927.

Date—	Fresh water number of wells in operation	Total production, G.P.M.
Feb. 8, 1927	9	11,900
Oct., 1932	9	13,000

The capacity is now over 1,700,000 gallons per day more than in 1927. Considering the fact that old wells are expected to decline in production, this increase in production is gratifying. What this actually means in saving can be calculated on the basis of new wells to give the same production or deeper pump settings. Lowering of the pumps to maintain production had been contemplated which would have cost approximately $20,000 per year. Since the inception of the equalization policy it has been unnecessary to deepen the settings. Lowering the pumps would be costly in power consumption as well as expensive and, perhaps, dangerous in increased mineral concentration of the water. A few examples of how the maximum production was obtained from each well are interesting to mention.

In the first place, specific capacities have been kept fairly constant, although there have been some changes. A prolific strata with a high hydrostatic pressure will result in a flow of water to those sands lower in pressure. If the higher pressure water contains, silica, calium carbonate, etc., there will be a tendency for the sand particles of the lower pressure formations to increase in size brought about by natural incrustations, in the process of the higher pressure water filtering through the sands. It is reported that this accumulation of incrustation amounts to an increase of over 65 per cent in the diameter of the grains over a period of five years. For a water sand formation of 11 per cent porosity the accumulation of incrustation reduces the porosity down to about 7 per cent. This naturally reduces the specific capacity. In view of this fact, drafts are exerted on the strata in accordance with the level conditions.

Where specific capacities have been decreased, different methods have been used to effect an increase. One of the wells (No. 4) was "shot" with solid carbon dioxide. The specific capacity was increased from 20 to 26. Two other wells (Nos. 6 and 18) were "shot" with No. 8 blasting caps. In each case the capacity was increased over 10 per cent. The gallonage of well No. 9 and other wells in well No. 7 area was increased by changing strata draft. Well No. 9 had declined to 1,140 g.p.m. After hard pumping of well No. 9 for two months, while idling well No. 7, the production showed an increase of almost 1,000,000 gallons per day as noted in Figure 5. The other wells in this cone showed an aggregate increase of about 500,000 gallons per day.

Another method of increasing production without causing too much interference between wells has been to regulate the drawdown to acquire the proper head for each well. For example, a test conducted on well No. 15 in October, 1930, indicated a drawdown of only 18.5 feet and a production of about 454 g.p.m. The desired head for the well was computed, and it was recommended that the drawdown be increased to 60 feet. This was done and the production is now over 2,500,000 gallons per day.

Another method used in maintaining good production has been to pump wells with high levels. Some of the wells have showed increases at the rate of 30 or more feet per year. This represents a substantial increase in production.

Alternate pumping of the wells is prolonging pump life. Especially is this true of the domestic group in which the pumps operate under high discharge pressure. Instead of pumping the entire group simultaneously, only one well is kept in service. Well No. 4 is the one operated the greater part of the time. However, level changes, pump conditions (whether of "A," "B," or "C" class), and other factors govern the well to be operated. These are appliacble to the industrial wells also.

Conclusion

It is obvious that the results thus far have proven that the plan of systematic extraction and utilization has effected a considerable saving in power consumption, treating costs, pump replacements, increased water production, and economies of an intangible nature. It is believed, however, that greater benefits will be reaped in future years. The greatest of these is naturally, the protection of the water supply.

Rubber Industry Now Uses Variety of Petroleum Naphthas as Solvents

The rubber industry naturally turned to the petroleum industry for a supply of low priced solvents and a number of variety of solvents have been prepared to meet the various demands. Representative specifications on such materials have been made available by one of the largest tire manufacturers and the following are the specifications that company has established to serve as standard for its purchases.

NAPHTHA A

Specifications—	
Specific Gravity	Shall be .74 to .78, Be.° 50.1 at 15.5° C.
Color	Shall be water white.
Distillation	Shall start at 105°-118° C. (239°-244° F.) and 95% shall distill below 200° C. (392° F.)
Residue on Evaporation	Shall not exceed 0.1%.

SPECIAL GASOLINE

Specifications—	
Specific Gravity	0.695 to 0.705.
Color	Water white.
Distillation	Shall start to distill at 45°-50° and 95% shall distill below 145°150° C. (302° F.)
Loss in Distillation	3% or less.
Residue on Evaporation	1.0% or less.
Foreign Matter	Free from acid, water and suspended matter.
Doctor Test	Negative.
Corrosion	Not corrosive to copper, as shown by Standard Corrosion test.

GASOLINE

Specifications—	
Sp. Gr. at 15.5° C.	0.73-0.74
Gravity, °A.P.I.	62.3-58.4
Color	Water white
Doctor Test	Negative
Corrosion (A.S.T.M. D130-30)	Negative
Foreign Matter	None

Method for determining distillation to be in accordance with A.S.T.M. Method D-86-30.

Distillation range—	°F.
Initial	168–172
10%	177–181
50%	185–189
90%	203–207
95%	207–212
Dry point	221

Source of Crude Oil—Shall be made from a crude oil of California or Texas origin which contains cyclic compounds such as "Cylo-Hexane" and similar hydro-carbons.

Successfully Use Phenol as a Selective Solvent

(Continued from Page 9)

to the oils discussed above, phenol treating has been applied successfully in the production of many other types of oils such as mineral seal oil, zero pale and red oils, paraffin distillates, extra heavy oils, etc. It is evident that this process has a very wide application in the refining of petroleum distillates.

Reduction in Sulphur Content. — The reduction in the sulphur content of a distillate brought about by phenol treating is considerable. Although up to the present time it is not known if the presence of sulphur compounds in a lubricating oil have a harmful effect, the results given in Table 5 are at least of scientific interest in studying the selective solvent action of phenol.

TABLE 5—SULPHUR REDUCTIONS IN COLOMBIAN MIXED DISTILLATE
Anhydrous Phenol Countercurrent Treating

Treat	Temp. °F.	Sulphur	% reduction
Untreated	distillate	.83	
100%	140	.34	59
150%	140	.29	65
100%	160	.28	66
150%	180	.18	78

The 59 per cent reduction obtained with 100 per cent phenol at 140° F. can be increased to 65, 66, or 78 per cent by increasing the treat to 150 per cent, raising the temperature to 160° F., and by increasing the treat to 150 per cent and the temperature to 180° F. respectively.

Utilization of Extracted Oil

Since the refining action of phenol is purely a physical one, the extracted oil has not undergone any chemical change as a result of the phenol treatment. Although this extract is unsuitable for lubricating purposes it has certain properties which make it a valuable by-product. Because of its high content of naphthenic and aromatic hydrocarbons it was cracked under the best available conditions and a fair yield of high octane number gasoline was produced. The extract can also be used for the preparation of a number of special products such as asphalt, etc.

Operating Costs

In Table 6 the average normal operating costs for phenol treating at the Sarnia plant are summarized.

TABLE 6—COST OF SERVICE REQUIREMENTS FOR PHENOL TREATING
Costs based on charge of 1,000 (U. S. 50-gal.) barrels per day.

Item—	Daily requirements	Unit cost in $	Cost in $ per day
Steam (1,000 lbs.)	157	.28	44.00
Water (gals.)	636	.007	4.45
Power (k.w.h.)	643	.007	4.50
Fuel (U. S. gals.)	4,220	.0135	57.00
Phenol (U. S. gals.)	50	1.27	63.50
Total			$173.45

The item of $57 per day for fuel is undoubtedly high. When full use is made of proper heat exchange equipment, which up to the present time has not been installed at Sarnia due to the fact that the plant was built as an experimental undertaking, it has been estimated that the fuel consumption can be decreased to approximately $25 per day.

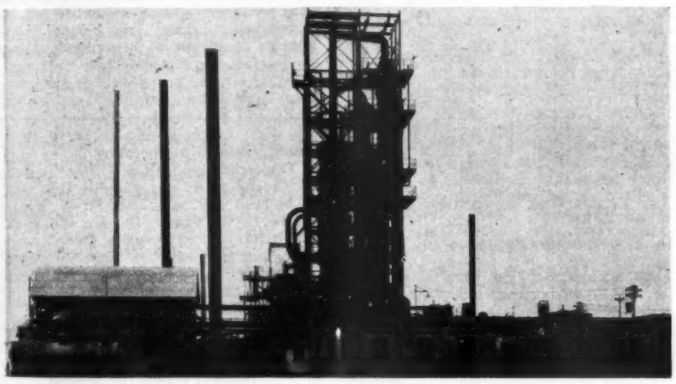
The phenol costs given in Table 6 are based on a loss of phenol of 0.1 per cent by volume on the charge of distillate. Only 0.03 per cent of this amount is actually accounted for by phenol determinations on the extract and dephenolized oil leaving the plant. It is difficult to state what the additional loss of 0.07 per cent is due to, but this figure is currently being further reduced by improving the operating conditions.

Summary and Conclusions

A few of the many advantages in favor of the use of anyhdrous phenol as a selective solvent refining agent for petroleum distillates may be summarized as follows:

1. Phenol does not react with the oil or decompose under any condition encountered in the extraction process.
2. Phenol treating is carried out at temperatures 100°-180° F.) which can be attained with the expenditure of comparatively little energy and separation of the phenol from the oil is accomplished very easily by distillation.
3. The density and solubility of phenol at the treating temperatures are such that well defined extract and raffinate layers quickly separate.
4. Phenol has a sharply defined preferential solubility for the undesirable components of a distillate as shown by its ability to bring about excellent improvements.
5. Phenol treatment eliminates or reduces acid finishing and lessens the amount of clay used for contacting.
6. The treating plant does not require any unusual equipment and it can be operated by three men. Consequently, labor and investment costs are small.
7. Under normal operating conditions, phenol is noncorrosive to ordinary refinery equipment, it is nontoxic, and requires less handling precautions than sulphur acid.

The most striking feature of selective solvent refining with anhydrous phenol is the unique ability of phenol to produce, economically, high grade finished lubricating oils, capable of withstanding the most exacting laboratory and service requirements from comparatively low grade flash coil distillates. For the past 2½ years, the Imperial Oil Refineries at Sarnia have been producing exceptionally high quality automobile, airplane, transformer and turbine oils, as well as a number of specialty oils, and producing these oils from Colombian distillates. The cost of processing these oils is low because the phenol treating expenses are moderate and definite savings have been made in the cost of finishing as compared to the regular method of acid and clay treating.



Another view of phenol treating plant at Sarnia refinery showing (left to right) dephenolizing coil for extract, bubble towers and treating room.

COMPLETION IN MEXICO

International Petroleum Co. is reported to have completed No. 5 Sabalo well in Corcovado, Mexico, flowing 20,000 bbls. of oil daily.

Elect F. R. Clark, Tulsa, President of A.A.P.G.

(Continued from Page 14)

would be exhausted before the oil at great distances would be set in motion toward the well.

In the program of subjects for special interests, Russell Ryan presented a summary of a paper being prepared by himself and W. F. Bowman on the Conroe Field. A "Review of the Tertiary and Quaternary Stratigraphy of Southern Louisiana," was given by H. V. Howe. Mr. Howe initiated considerable discussion over his suggestion that the name of the Wilcox formation should be changed to "Sabine." F. B. Plummer gave a "Review of Classification of Tertiary Strata of Texas and a Discussion of Significant Horizons in the Gulf Coast Section." He pointed out that the Tertiary of the Gulf Coast had been divided into seven groups and 20 formations.

Papers on Gulf Coast

Alexander Deussen, consulting geologist of Houston, discussed the "Producing Horizons in the Gulf Coast," in which he classified the periods of production and development in the Gulf Coast, namely; the original cap rock production period; next, the development of the shallower flank sands in the Miocene; then the Oligocene sand development; the Jackson sands and fields, and more recently the Cockfield sand production, the latter being introduced by Pettus and Conroe. He brought out that in each successive division increasing potential reserves of petroleum were indicated. Some lower horizons, such as the Cook Mountain and Mount Selman have been touched in certain fields but as yet their possibilities remain to be explored.

A "Review of Developments in the Gulf Coast During the Recent Past" was presented by Dr. J. B. Eby of Houston. Dr. Donald C. Barton, another consulting geologist and geophysicist of Houston, discussed the "Gulf Coast Geosyncline." He stated that a gravity "geominimum" extends eastward through the Gulf Coast and seems to indicate a geosyncline connecting eastward with the Appalachian geosyncline. He pictured the great thickness of Tertiary-to-Quaternary beds, which he believes to be more than 30,000 feet thick in certain districts, namely, in the delta south of New Orleans.

Miss Alva C. Ellisor, chief paleontologist of the Humble Oil & Refining Co., who has been active in working out divisions and subdivisions of the Jackson group in an effort to determine some reliable marker which can be used over a wide territory, offered a "Correlation of the Jackson Group of Texas, With Notes on the Frio and Vicksburg."

Other special papers on the Gulf Coast discussed included "Sugarland Oil Field," by W. B. McCarter and P. H. O'Bannon; "Overhanging Salt on Salt Domes of Texas and Louisiana," S. A. Judson and R. A. Stamey; "Texas and Louisiana Salt Dome Cap Rock Minerals," Dr. Marcus A. Hanna and Albert C. Wolf; "Origin of Caliche, and the Reynosa Problem of South Texas." and "The Possible Role of Disastrophism in Topography of the Corpus Christi Area," both by W. Armstrong Price; "Surface and Subsurface Relationships of Yegua, Jackson and Frio Formations in Southwest Texas," Fred P. Shayes; "Surface Fractures of South Texas," Dr. Donald C. Barton; "The Raccoon Bend Oil Field," L. P. Teas and C. R. Miller.

Outside Gulf Coast

Some papers in the symposium of special subjects dealing with areas of Texas outside the Gulf Coast, and Northeastern New Mexico, included "Some Structural Features of Trans-Pecos, Texas," P. B. King; "Upper Pennsylvanian Section of Colorado River Valley, Texas," Fred M. Bullard and Robert H. Cuyler; "Areal Geology of the Eocene North of Rio San Juan, Northeastern Mexico," William G. Kane and Guy B. Gierhard; "Studies Along Part of the Mexia Fault Zone," David J. Crawford, and "Structure and Stratigraphy of Kelsey Dome, Upshur County, Texas," A. R. Denison, A. E. Oldham and A. W. Kisling. Several of the above and a few others were presented by "title" only.

Held concurrently with the above was a symposium Saturday morning for papers on areas outside of Texas, Louisiana and northeastern Mexico, in which presentations of nine papers were scheduled. These included "Results of Structural Research Work in Beartooth-Bighorn Region," W. H. Bucher, R. T. Chamberlin and W. T. Thom, Jr.; "Structure of Southeastern Utah," A. A. Baker and C. H. Dane; "Pennsylvanian Salt Bearing Paradox Formation in Eastern Utah and Western Colorado," A. A. Baker, C. H. Dane and J. B. Reeside, Jr.; Upper Paleozoic Red Beds of Colorado" and "The Mississippian of Colorado," both by J. Harlan Johnson and A. E. Brainerd; "Subdivision of Quartermaster Formation of Oklahoma and Its Relationship to Known Triassic of the Texas Panhandle," H. L. Griley; "The Cut Bank Oil and Gas Field, Glacier County, Montana," J. S. Irwin; "Petrographic Studies on Correlation of Sands from Kettleman Hills, California," M. N. Bramlette, and "Geology of Potter and McKean Counties, Pennsylvania," H. Rogers Van Gilder. Several of the above also had to be introduced by title because of shortage of time.

Programs of both the Paleontology and Mineralogy and the Geophysical divisions were crowded with detailed technical papers. The Geophysical program was opened by two papers of general interest, one by the president, Paul Weaver, of the Gulf Production Co., on the "Relations of Geophysics to Geology," and the other by C. E. Van Orstrand on "Some Possible Applications of Geothermics to Geology."

The closing afternoon was set aside for a trip to the Conroe Field, which attracted a large number of the visiting geologists. On Sunday the visitors were taken to the Sugarland Field, where they were guests of the Humble Oil & Refining Co., and from there to Bolingwhere they inspected the sulphur mines of the Texas Gulf Sulphur Co. There they were guests of the latter company at luncheon. Entertainment features of the convention included a banquet and dance Friday night and a golf tournament.

Curve Simplifies Design of Plant Pipe Line System

(Continued from Page 24)

intersecting scale A. 6. Draw a straight line from point on scale A to point on scale E and read answer on scale C, which shows that a 6-inch pipe is required.

Example 2. Find the capacity of a 6-inch line for the following conditions:

Sp. gr. of gas (air=1)	1.0
Average temp. of gas, ° F.	60
$P_1^2 - P_2^2$	1,000
Length of line in feet	1,000

1. Draw a straight line through values on scales D and F. 2. Draw a straight line through point on E scale and size of pipe on C scale. Extend line to scale A and read answer—225,000 cubic feet per hour.

Example 3. Find the pressure loss in a 6-inch line carrying 225,000 cubic feet per hour of gas having a specific gravity of 1.0; an average temperature of 60° F., and an initial pressure 55 pounds per square inch absolute.

1. Draw a straight line from 225,000 on scale A through 6-inch pipe size on scale C, and extend line across plain scale E. 2. Draw a straight line from 1,000 on scale F through point on scale E, and extend line across scale D, which shows a value of 1,000. 3. $P_1^2 = 55^2 = 3{,}025$. $P_2 = \sqrt{3{,}025 - 1{,}000} = 45$. Pressure loss $= 55 - 45 = 10$ pounds.

Note—Blueprinted copies of the gas line flow chart, with instructions, on 8½x11 sheets may be obtained for a small charge by addressing W. A. Stover, Box 1781, Tulsa, Okla.

Osage Leases Average 31c Per Acre at Sale

Twenty-eight quarter sections of land in Osage County, Oklahoma, were auctioned off for oil and gas purposes for $3,900 at a public sale held in Pawhuska on March 21. This was an average of 87 cents per acre. Twenty-three of the leases sold for $50 each, or an average of about 30 cents per acre.

There was a period in the history of the famous Osage County oil field when 36 quarter sections were sold for prices ranging from $600,000 to $1,990,000, or a total of $37,808,000, an average of over $6,500 per acre, but now the "poor Indian" finds it hard to dispose of most of what is left unleased of the 1,500,000 acres that comprise Osage County at any price, notwithstanding the liberalized terms of the leases, which give the purchaser five years in which to complete a well providing he pays a nominal rental.

With the exception of the National Refining Co., none of the large companies took any interest in the latest sale. The National Refining Co. bought four quarter sections at $50 each.

The quarterly Osage payment took place on Wednesday, March 22, the Federal Government paying $205 to each of the 2,229 headrights in the tribe.

Following were the tracts sold, the buyers and the bonus prices paid:

Tr.	Purchaser and description—	Bonus
1	Link Oil Co., NW 4-22-12	$100
4	D. D. Simmons, NE 31-29-12	50
5	D. D. Simmons, NW 32-29-12	50
6	Norbia Oil Co., NE 1-26-11	50
9	Norbia Oil Co., NE 4-21-11	50
10	Norbia Oil Co., NW 4-21-11	50
11	Roy D. Stone, SW 21-21-11	50
12	Roy D. Stone, SE 25-21-11	50
17	James E. Morrison, SE 35-25-11	50
24	J. R. Higgins, SW 12-21-10	50
25	Maroydon O. G. Co., SE 25-21-10	50
26	Maroydon O. G. Co., SW 25-21-10	50
27	J. R. Higgins, NE 36-21-10	50
28	Norbia Oil Co., NW 8-22-10	50
30	National Ref. Co., SW 28-23-9	50
32a	Norbia Oil Co., SE 20-23-9	50
46	National Ref. Co., SE 8-26-9	50
47	National Ref. Co., SW 8-26-9	50
48	Norbia Oil Co., NE 6-24-8	50
52	Iron Mtn. Oil Co., SW 20-24-8	50
53	R. J. Barrett, SW 29-24-8	50
56	National Ref. Co., SW 18-26-8e	50
57	A. H. Kasishke, NE 36-26-8	700
63	Mid-Co Oil Corp., NW 10-25-6	300
64	C. W. Titus Co., NW 32-26-6	550
65	C. W. Titus Co., SW 32-26-6	1,100
66	C. W. Titus Co., SE 4-25-3	50
68	C. W. Titus Co., NE 9-25-3	50
28	4,480 acres	$3,900

KINLEY TO COLOMBIAN FIRE

A well being drilled by the Colombia Petroleum Co., subsidiary of the Gulf Oil Corp., Pittsburgh, Pa., on the Barco concession in Colombia, South America, blew out about three weeks ago and caught fire. The well has been out of control ever since and M. M. Kinley, Tulsa fire fighter, is now en route to it via private plane from Tulsa to Miami, Fla., and the Pan-American Airways, Inc., from there to Maracaibo, Venezuela, to extinguish the fire. Mr. Kinley is well known as a fire fighter with credit for having put out numerous stubborn fires in this and foreign countries. His latest big fire was the one in Rumania which he brought under control after it had burned for about two years and three months.

MEETING OF ACCOUNTANTS

The next regular meeting of the Petroleum Accountants Society will be held Thursday, March 30, at 6:15 p. m., at the Mayo Hotel, Tulsa. The program committee has arranged for the presentation of the following papers: R. R. Zimmerman, of the Continental Oil Co. of Ponca City, will discuss "Personnel," outlining the advantage of centralizing employment, against each department hiring. J. F. Finney, of Continental Oil Co., will speak on "Forms Supervision," outlining the advantages of centralized forms under the control of one department. L. D. Messner, of Barnsdall Oil Co., will present the subject of "Expense Accounts," outlining what employes are permitted expenses, and what limit is placed on these accounts.

California Oil Field Operations for January, 1933

According to figures collected by the American Petroleum Institute, Pacific Coast office, the total production of crude oil in California for January amounted to 14,460,282 bbls., an average of 466,461 bbls. per day. This is a decrease of 4,346 bbls. per day under December production.

Total stocks of crude and all products in Pacific Coast territory decreased during the month 829,941 bbls. Total stocks at the end of the month were 167,416,484 bbls.

CRUDE PETROLEUM PRODUCTION
(Figures of Production and Stocks are in barrels of 42 gallons)

	Barrels per month	Daily average Jan., 1933	Dec., 1932	Jan., 1932
Group No. 1:				
Coalinga	338,359	10,915	10,668	7,302
Elk Hills	376,574	12,148	11,952	12,662
Fruitvale	144,607	4,665	5,073	3,598
Kern River	269,647	8,698	8,593	9,884
Kettleman Hills—North Dome	1,794,516	57,888	59,526	60,265
Kettleman Hills—Middle Dome	.....	.....	.....	.....
Lost Hills-Belridge	279,807	9,026	9,765	9,719
McKittrick	54,021	1,743	1,642	1,734
Midway-Sunset	1,486,925	47,965	47,263	48,668
Mount Poso	241,279	7,783	7,510	8,191
Round Mountain	70,479	2,273	2,209	1,378
Wheeler Ridge	14,522	468	490	531
Group No. 2:				
Capitan	.....	.....	.....	.....
Elwood	431,506	13,597	13,345	16,430
Rincon	65,230	2,104	2,064	1,630
San Miguelito	29,075	938	1,028	342
Santa Barbara	13,002	420	690	313
Santa Maria	82,362	2,657	2,915	2,532
Summerland	3,005	97	94	108
Ventura Avenue	1,132,507	36,542	37,535	40,387
Ventura-Newhall	84,971	3,064	2,887	3,559
Watsonville	1,937	62	62	62
Group No. 3:				
Coyote	302,629	9,763	10,058	9,712
Dominguez	568,535	18,351	18,316	16,135
Fullerton (Brea Olinda)	238,191	7,683	7,912	8,989
Huntington Beach	798,346	25,753	23,783	22,125
Inglewood	378,353	12,205	12,312	13,762
Lawndale	7,674	248	216	235
Long Beach	2,135,392	68,561	70,380	77,888
Los Angeles-Salt Lake	27,305	881	982	1,165
Montebello	145,165	4,683	4,917	6,235
Newport	.....	.....	.....	22
Playa Del Rey	397,026	12,807	13,341	20,182
Potrero	18,040	582	602	992
Richfield	181,786	5,864	5,856	6,459
Rosecrans	91,466	2,950	3,011	3,109
Santa Fe Springs	1,694,144	54,650	55,339	65,292
Seal Beach	346,980	11,193	10,955	13,296
Torrance	189,604	6,116	5,959	6,228
Whittier	34,664	1,118	1,058	1,066
Total January	14,460,282	466,461	470,807	501,037
Total December	14,595,028	470,807	.....	.....
Decrease	134,746	4,346	.....	.....

TOTAL STOCKS HELD BY CALIFORNIA OIL COMPANIES, BOTH INSIDE AND OUTSIDE THE UNITED STATES

	Jan. 31, 1933	Dec. 31, 1932	Jan. stock decreases	Jan. 31, 1932
Heavy crude and all grades of fuel, gas and Diesel oils	100,796,706	101,174,293	377,587	98,914,561
Refinable crude	39,239,180	39,399,041	59,861	42,202,110
Finished gasoline, engine distillate and natural gasoline	15,726,068	15,670,771	†55,297	16,621,657
Crude gasoline and naphtha distillates	4,842,144	4,909,408	67,264	4,353,539
All other stocks	*6,813,386	17,192,912	380,536	$8,252,187
Total all stocks	167,416,484	168,246,425	829,941	170,444,054
†Increase. Barrels of coke included	*661,772	‡652,494		$636,449

OIL FIELD DEVELOPMENT

	New rigs up	Active drilling	Producers completed	Daily initial output	Active producing	Abd. wells Drillers	Abd. wells Producers
Group No. 1—							
Coalinga	6	0	9	0	668	0	3
Elk Hills	0	0	0	0	184	0	0
Fruitvale	3	2	0	0	50	0	0
Kern River	0	0	0	0	950	0	0
Kettleman North Dome	3	14	0	0	37	0	0
Kettleman Middle Dome	0	0	0	0	0	0	0
Lost Hills-Belridge	0	3	0	0	140	0	0
McKittrick	0	0	0	0	115	0	0
Midway-Sunset	0	1	0	0	1,760	0	10
Mount Poso	3	1	1	755	95	0	0
Round Mountain	2	2	2	506	20	0	0
Wheeler Ridge	0	0	0	0	34	0	0
Group No. 2—							
Capitan	0	0	0	0	0	0	0
Elwood	0	0	1	415	36	0	0
Rincon	0	2	0	0	34	0	0
San Miguelito	0	1	0	0	3	0	0
Santa Barbara	0	0	0	0	5	0	0
Santa Maria	0	0	0	0	165	1	0
Summerland	0	0	0	0	64	0	0
Ventura Avenue	0	6	1	870	159	0	0
Ventura-Newhall	0	10	0	0	427	1	1
Watsonville	0	0	0	0	6	0	0
Group No. 3—							
Coyote	0	1	1	1,894	58	0	0
Dominguez	1	3	1	325	56	0	1
Fullerton	0	0	0	0	354	0	0
Huntington Beach	0	3	3	1,274	389	0	1
Inglewood	0	0	0	0	219	0	0
Lawndale	1	0	0	0	6	0	0
Long Beach	1	24	2	443	946	1	1
Los Angeles-Salt Lake	0	0	0	0	321	0	2
Montebello	0	0	0	0	151	0	0
Newport	0	0	0	0	0	0	0
Playa Del Rey	0	3	0	0	199	2	2
Potrero	0	0	0	0	12	1	0
Richfield	2	0	0	0	155	0	0
Rosecrans	0	1	0	0	65	0	0
Santa Fe Springs	0	0	0	0	509	0	1
Seal Beach	0	0	0	0	101	0	1
Torrance	0	0	0	0	378	0	0
Whittier	0	0	0	0	140	0	0
Miscellaneous drilling	0	22	0	0	0	1	0
Group No. 4—							
Buttonwillow gas field	1	1	1	gas	2	1	0
Dudley Ridge gas field	0	5	0	0	0	1	5
Goleta gas field	0	0	0	0	0	0	0
Total January	17	98	12	6,382	5,948	9	23
Total December	25	82	13	9,121	5,901	8	18
Increase	*8	16	*1	*2,739	47	1	5
Average for year 1932	18	108	15	13,069	5,928	16	14
Average for year 1931	32	207	21	30,370	5,911	20	15
Average for year 1930	80	434	62	48,710	9,633	21	27

*Decrease.

H. C. Brewster, Maker of Oil Field Equipment, Dead

SHREVEPORT, La., Mar. 27.—H. C. Brewster, aged 64, president and founder of the Brewster Co., of Shreveport, formerly the Oil City Iron Works, manufacturer of oil field equipment, died suddenly of a heart attack Thursday, March 23. He had gone to bed in apparently good health, and death came while he slept. Mr. Brewster leaves his wife, two daughters and three grandchildren, all residing in Shreveport.

Besides his manufacturing business Mr. Brewster was the owner and operator of the Jefferson Hotel here and was half owner of the Ricou-Brewster office building. Among the oil field tools and equipment manufactured by the Brewster Co. several were of his own invention. He had resided in Shreveport since 1900, coming here from New Orleans.

To Seek Improvements in Marketing Practices

(Continued from Page 12)

Born of the University of Tulsa on a kindred subject, namely: "Effect of Acid Treating on the Octane Value of Pressure Gasoline." To conclude the afternoon session of the first day, an open discussion of "operators ideas" will be held with J. J. Allinson of the Lion Oil Refining Co., leading the discussion. It is hoped that operators will be willing to tell how improvements have been made in the routine operation of their plants through developing certain little pieces of equipment or routine practices that have saved time and money. An exchange of such ideas will be sought at the meeting and the open forum should prove to be unusually helpful to operators.

The technical meeting will be continued on the following day and the first paper to be read will be that of B. W. Vinson, of the B. W. Vinson Co. He will discuss "Unit Support of Furnace Walls," a matter which can save refiners considerable money in the maintenance of furnace walls on new installations.

This will be followed by a general discussion of the revision of the "Octane Brackets" as stated more in detail previously. This will be led by R. R. Irwin.

General Executive Session

Following his opening remarks as chairman of the executive session, George D. Locke, vice president of Barnsdall Refineries, Inc., and president of the Western Petroleum Refiners Association, will deliver the president's address. Elected to the presidency a year ago, Mr. Locke has been most actively identified with the marketing problems of the association members. Following this, H. G. Nevitt, of the White Eagle Oil Corp., will read a paper on road oil and will outline the advantages to be gained by the Mid-Continent refiner who will encourage an expansion of the use of this product.

Following this the report of the committee on revising the octane brackets will be discussed and it is hoped that definite action will be taken. Upon the conclusion of this report two papers are to be delivered which discuss present marketing practices.

Every Mid-Continent refinery executive has felt the weight of the extremely competitive conditions that have been maintained in both the tank car and retail markets throughout the Middle West during the past year. Because there is no apparent remedy and because conditions have drifted month after month these speakers are hopeful of stirring up a renewed interest in constructive measures that they will discuss which may lead to a way out.

The final meeting will be concluded with a report of committees and the election of officers.

NEW KANSAS COMMISSION

The personnel of the newly formed Kansas Corporation Commission is composed of Homer Hoch, chairman, with J. W. Greenleaf and Ernest E. Blincoe, commissioners. This commission was formed to replace the Kansas Public Service Commission.

Ward County Is Busiest District in Permian Basin; Wichita Falls Area Has 36 New Locations

By L. E. BREDBERG
Fort Worth Bureau, The Oil and Gas Journal

FORT WORTH, Tex., Mar. 27.—Stanolind Oil & Gas Co. and others' Ordovician test on the Todd ranch in Block UV, G.C.&S.F. Survey, Crockett County, was treated with acid during the past week and is now swabbing at 5,400 feet. Present total depth is 7,720 feet, at which point it was plugged back from its former total depth of 8,041 feet. The test was treated with 1,720 gallons of acid in an effort to disintegrate the lime and make a producer from the streak of saturation which was penetrated. A shot may later be tried. The test is on a unitized block of acreage held by several majors and independents. A shallow producer has already been completed to prove and hold the block.

Fisher and Jones Prices

Fisher and Jones County producers obtained a boost in price for their oil this week when Humble Oil & Refining Co. discontinued paying the flat price of Permian Basin oil, 30 cents, and announced that it would pay the regular Mid-Continent price for this crude, which is 36 gravity. Top price of Mid-Continent crude is 52 cents per barrel for 40 gravity and above. The increase went into effect on March 24. Shell Petroleum Corp. is another major purchaser taking oil from this area.

Pat O'Donnell's No. 1 Pardue in Section 202, B.B.B.&C. Survey, Fisher County, is appearing as a 2,000-foot western extension well to the Royston Pool. Pay was topped at 3,104 feet and the test shut down at 3,106 feet, making one head of oil estimated at 40 bbls., before being shut in to erect storage.

Reagan County

The Big Lake Field, Reagan County, has another deep producer. This well is owned by Big Lake Oil Co. and is on the west or low side of the field, and is bottomed at 8,800 feet, flowing an average of 2,310 bbls. for the first five days. There are four other tests drilling toward the deep pay in the field.

Ward County

There were five wells completed in Ward County during the week, and one abandoned. The dry hole was drilled by J. D. Kugle and others on the Keasler ranch in Section 46, Block 34, H.&T.C. Survey. Total depth is 2,823 feet. Ward County continues to lead in drilling activities in the basin, the southern part, near Grand Falls, witnessing most of the drilling, while the O'Brien area in the northern part is also receiving some attention, two or three wells going down in that area all the time, the Gulf Production Co., largest acreage holder under this ranch, doing the operating.

Ector County

Stanolind Oil & Gas Co.'s No. 1 Cowden in Section 26, Block 43, Township 2s, T.&P. Survey, north offset to Harrison, Turner and others' No. 1 Addis, discovery well, Ector County, should be the next test to be completed in this new active area. It is shut down with 8⅝-inch casing cemented at 3,728 feet. Total depth is 3,735 feet. Total depth of the Addis discovery is 4,051 feet. Drilling should be resumed on the Cowden test this week and top of the pay soon encountered. Top of the pay is expected around 3,800 feet.

Winkler County

The Llano-Scarborough Pool in north Winkler County was hemmed in on the east this week by Sid Richardson and others' dry hole in the center of the SW SW, Section 5, Block C-22, P.S.L. Survey. It was abandoned at 3,455 feet after striking sulphur water at 3,447 feet, thereby failing to make a mile extension to the pool.

WICHITA FALLS

There were 36 locations staked in the Ranger and Wichita Falls districts during the week with 29 wells undergoing acid treatment. All areas in these two districts, not producing from sand horizons, are receiving treatment, practically all wells responding successfully. On test, W. B. Hamilton and others' No. 1 Ikard, in the Archer City area, Archer County, appeared as a dry hole when tested in lime at 1,168 feet, but after treating it made a 25-bbl. pumper. One thousand gallons of acid was used in the treatment.

The Texas Company's No. 1 E. L. Burns in Section 1,986, T.E.&L. Survey, eastern Young County, is to be plugged back to the Bend lime horizon around 4,122 feet where it made some oil, flowing by heads several months ago. This week it encountered sulphur water in the Ellenberger lime at 5,102 feet. If it does not show as a commercial producer at 4,122 feet it will probably be treated with acid or given a shot.

PANHANDLE

All companies and independent operators except two have joined in the voluntary proration of the Panhandle Field regardless of the Railroad Commission granting permission to everyone to flow their wells as they desired. This permission came after the Danciger Oil & Refining Co. secured a Federal court order against the commission. Offset wells are being flowed to prevent drainage as was the case when the Danciger company formerly held an injunction against the commission. It has been definitely proved that the field cannot possibly make the large potential assigned it, as has been done in many cases during the history of fields in this and other states. The field is now producing around 43,000 bbls. per day, its former proration allowable under proration orders. Opening this field during the week may be good medicine, operators finding that the field is overrated in regard to potential production.

Production in the field increased to around 55,000 bbls. per day until the operators began shutting in their wells voluntarily, thereby meeting daily nominations of the purchasing companies.

COMPLETIONS IN WEST TEXAS

Concho County

Mann and others' No. 1 Hartgraves, dry and abandoned, total depth 1,201 feet.

Ward County

J. D. Kugle and others' No. 1 Keasler, dry and abandoned, total depth 2,823 feet. J. C. Maxwell's No. 1 Smith, shot 70 quarts from 2,455-76 feet, initial production 45 bbls., total depth 2,800 feet, elevation 2,536 feet. Texas Pacific Coal & Oil Co.'s No. 7 James, top pay 2,285 feet, initial production 45 bbls., total depth 2,610 feet. Gulf Production Co.'s No. 26 O'Brien, initial production 75 bbls., total depth 2,752 feet; No. 28 O'Brien, initial production 280 bbls., total depth 2,661 feet, elevation 2,661 feet.

Winkler County

Sid Richardson's No. 1-C Scarborough, dry and abandoned, total depth 3,455 feet, elevation 2,926 feet.

Upton County

Gulf Production Co.'s No. 102 McElroy, top pay 2,857 feet, initial production 170 bbls., total depth 2,931 feet.

COMPLETIONS IN PANHANDLE

Carson County

Panhandle Refining Co.'s No. 1 Kirby, gas pay 2,520-2,719 feet, initial production 20,000,000 feet of gas, total depth 2,719 feet.

Gray County

Skelly Oil Co.'s No. 3-A S. Jackson, top pay 3,108-15 feet, initial production 217 bbls. third 24 hours on pump, total depth 3,115 feet. The Texas Company's No. 6 H. M. Davis (old well recompleted), initial production before deepening 5 bbls., increase oil 3,211-16 feet, new total depth 3,216 feet, initial production 20 bbls.

Wildcat Operations in West Texas

Week Ending March 27

BREWSTER COUNTY

Company, well, farm name, section and block—	Remarks:
Joiner's No. 1 McIntire, 853 ft. from S and 2,390 ft. from E, Sec. 31, Blk. 352, W. J. Mitchell Sur.	T.D. 550 ft.; fishing tools.

CONCHO COUNTY

Beasley et al's No. 1 Waring Estate, 400 ft. from N and E, Sec. 163, T.&N.O. Sur.	T.D. 2,586 ft.; pumping 5 bbls. oil per day and some water.

CRANE COUNTY

Gulf Prod. Co.'s No. 103 McElroy, 1,980 ft. from S and 660 ft. from W lines of Sec. 197, Blk. F, C.C.S.D. R.G.N.G. Sur.	Rigging up rotary.

CROCKETT COUNTY

Chambers et al's No. 1 Hoover, 1,650 ft. N and 330 ft. from E, Sec. 1, Blk. FF, B.&B. Sur.	Tested 5 bbls. per day after shots: T.D. 2,105 ft.; S.D.
Stanolind Oil & Gas Co. et al's No. 1 Todd, 1,370 ft. from N and 1,320 ft. from E, Sec. 67, Blk. UV, G.C.&S.F. Sur.	T.D. 8,042 ft.; plugged back to 7,720 ft.; poured acid; now standing.
The Texas Company's No. 1 B. B. Ingham, 330 ft. from S and 2,330 ft. from E line, Sec. 36¼, T.&G.N. Sur.	S.D. 2,504 ft.

CULBERSON COUNTY

Miller Bros.' No. 1 fee, 1,980 ft. from N line and 660 ft. from E line of Sec. 61, Blk. 97, P.S.L. Sur.	Drlg. 350 ft.

DAWSON COUNTY

Ray Albaugh et al's No. 1 John Robinson, 1,320 ft. from N and W, Sec. 46, Blk. M, E.L.R.R. Sur.	Fishing bit 50 ft.

ECTOR COUNTY

Cherry et al's No. 1 Johnson, 1,320 ft. from S line and 660 ft. from E line of Sec. 41, Blk. 43, Twp. 1s, T.&P. Sur.	S.D. 1,203 ft.
L. C. Harrison et al's No. 1 Addis, 330 ft. from N and 1,320 ft. from W, Sec. 35, Blk. 43, Twp. 2s, T.&P. Sur.	T.D. 4,051 ft.; flowing 450 bbls. day.
Landreth Prod. and The Texas Company's No. 1 Holt, 660 ft. from S line and 2,025 ft. from E line of Sec. 16, Blk. 43, Twp. 1s, T.&P. Sur.	Derrick; elev. 3,090 ft.
Stanolind O. & G. Co.'s No. 1 Cowden, 330 ft. from S and 1,320 ft. from W, Sec. 26, Blk. 43, Twp. 2s, T.&P. Sur.	Cmtd. 8-in. csg. at 3,785 ft.
Thomas et al's No. 1 Edwards, 330 ft. from S, 2,310 ft. from E, Sec. 38, Blk. 43, Twp. 3s, T.&P. Sur.	S.D. 3,327 ft.

EL PASO COUNTY

Tri-State Oil Co.'s No. 1 Bobadella, 1,325 ft. from S and E lines Sur. 254, S.F. No. 7,247	Fishing 3,190 ft.

FISHER COUNTY

Cranfill & Reynolds' No. 2 George, 330 ft. from N and W lines of NE of Sec. 200, Blk. 1, B.B.B.&C. Sur.	Spudded.
Cranfill & Reynolds' No. 3 B. F. Willingham (standing since March, 1931)	T.P. 2,097 ft.; est. 75-bbl. well.
O'Donnell's No. 1 Pardue, 330 ft. from S and E lines of N half of SW Sec. 202, B.B.B.&C. Sur.	S.D. 3,112 ft.; 1,000,000 ft. gas, 2,000 ft. oil in hole in 48 hrs.
Southern Oil Co.'s No. 1 Beavers, 330 ft. from W and 660 ft. from S of S half of SW Sec. 193, B.B.B.&C. Sur.	T.D. 415 ft.; setting 12½-in. csg.

(Continued on Page 94)

ROCKY MOUNTAIN RUNS

Average daily pipe line runs from fields in the Rocky Mountain territory for the week ending March 25 follow:

	Bbls.
WYOMING	
Salt Creek	20,060
Big Muddy	1,910
Badger Basin	50
Byron Garland	130
Dallas-Derby	540
Dutton Creek	80
Elk Basin	610
Ferris	20
Frannie	210
Grass Creek	1,730
Greybull	10
Hamilton Dome	0
Hudson	360
La Barge	1,000
Lance Creek	50
Lost Soldier	1,560
Midway	90
Oregon Basin	290
Osage	740
Pilot Butte	30
Rock River	1,470
Poison Spider	170
Teapot	30
Total Wyoming	31,140
MONTANA	
Buckley-Border	370
Cat Creek	750
Cut Bank	320
Dry Creek	16
Kevin-Sunburst	3,150
Lake Basin	50
Pondera	920
Total Montana	5,570
COLORADO	
Florence	260
Fort Collins and Wellington	690
Iles Dome	510
Moffat	560
Orchard	170
Rangely	40
Tow Creek	260
Total Colorado	2,490
NEW MEXICO	
Artesia	455
Caprock	300
Hogback	240
Jal	1,205
Table Mesa	70
Eunice	464
Hobbs	30,296
Lea	2,335
Texas-Pacific	89
Rattlesnake	680
Total New Mexico	36,734
Total Rocky Mountain area	75,934
Total previous week	76,292
Difference	358

Open Flow Test in East Texas Is Still Uncertain; Seven New Wildcat Locations Are Staked

By L. E. BREDBERG

DALLAS, Tex., Mar. 27.—Following an order by the Railroad Commission for a two-hour open flow test of the nearly 10,000 wells in East Texas set for this morning, Commissioners C. V. Terrell and E. O. Thompson left for Washington to attend the oil conference there. Chairman Lon A. Smith of the commission later announced that the order had been rescinded but Commissioners Terrell and Thompson in Washington insisted the test had only been postponed until Thursday with an indefinite shut down thereafter.

Attorney General James V. Allred ruled Monday night that Chairman Smith, only member of the Texas Railroad Commission now in the State, could not issue a legal order to open all the 10,000 wells in the East Texas Field for a two-hour potential test flow Thursday, or to require the shut down of the wells. The other two commissioners will not reach Texas until Friday. They had acquiesced in the order, but it was not written and signed before they left. The former order, calling for the test and shut down March 27 expired Monday, unfulfilled since the commission verbally had announced its recision.

James E. Ferguson, who speaks for the governor's office, announced tonight the governor's office had investigated reports of threatened violence and disorder in the East Texas oil field and convinced itself the reports exaggerated conditions, and that no state action to preserve order is now required.

The commission received reports that over 400 wells of the Sinclair company in East Texas had been flowed wide open for two hours Monday, the company contending that no legal order had been made rescinding the order for the open flow test.

Capt. J. F. Lucey, independent operator of Dallas, had planned to sue for injunction to prevent the commission from making such a move, but after the order was retracted the injunction plans were dropped. If the plan to open wells for a couple of hours on March 30 is not dropped, an injunction will be filed immediately to prevent the commission from making such a move.

Commission Cited to Court

Judge Randolph of the Federal Court has ordered Commissioners Terrell, Smith and Thompson to appear before him at Sherman on April 8 and show proof why they should not be punished for "attempting to evade the orders and decrees of this court by making and putting into effect orders different in form but not in substance" from those held invalid by the three-judge Federal Court decision. This order comes as a result of the commission issuing an order based on the per well basis and other factors, after the court held against a method which gives consideration to the per well allowable.

Tank Car Shipment Peak

A great feeling of uncertainty hangs over the field, and conditions have been steadily growing worse during the past few weeks although the saturation point of illegal oil seems to have placed itself at around 125,000 to 150,000 bbls. per day. This is the amount of oil produced over and above the daily allowable of 400,000 bbls. However, there seems to be more relaxation in efforts to curb overproduction as tank car shipments during the week reached another peak point. Tank car shipments for the 24 hours ending at 7 a.m. on March 26 were 861 while on the day before they ran 714 cars and 734 cars in the 24 hours ending 7 a.m. March 27. Most of the "hot" oil is considered as going out by tank cars. The commission has apparently taken no steps to check the amount of oil run by small gathering lines to the tank car loading racks, which is said to be the only method possible for preventing shipping out overproduced oil by rail.

Ask Federal Control

A group of operators and landowners in Kilgore and Longview have wired Secretary of the Interior Ickes requesting Federal intervention in the field, and a group of East Texas landowners had planned on being in Austin when the legislature called its hearing on a bill to set up a separate oil and gas commission, appointed by the governor, to replace the present railroad commission. During the past few months this desire has rapidly gained headway among oil landowners, royalty owners and producers in Texas, especially in East Texas where conservation orders have been continually disobeyed.

Another petition was on its way to Governor Miram Ferguson from the East Texas Landowners Association to request immediate executive action to prevent "violence and bloodshed" in the field.

Three major producing companies, along with a number of independents, opened their wells this morning to capacity, flowing them open for two hours as formerly ordered by the commission. These producers stated that they failed to get proper notice of the postponement of the order. In addition to the Sinclair Prairie Oil Co., Arkansas Fuel Oil Co. and Empire Gas & Fuel Co. were named as opening their wells. It is not known how much oil was produced during the two hours open flow. If, as the commission has announced, wells are allowed a two hours' open flow later those opened Monday will probably be restrained from opening them again thereby making up for today's misunderstanding.

Another Injunction

Rowan & Nichols Oil Co., of Fort Worth, has obtained a Federal Court injunction against the commission's newest

Many Problems Are Involved in Proposal to Take Potentials in the East Texas Fields

By L. G. E. BIGNELL
Petroleum Engineering Editor

Many problems are presented in the proposal to take potentials of wells in East Texas through the plan of opening all wells and permitting them to flow at capacity at the same time during a two-hour period. There are approximately 9,950 oil wells in the East Texas Field which covers an area of 112,000 acres or 175 square miles. Of this number 250 may be deducted as being pumpers and therefore not covered by the orders. There remain 9,700 wells to be opened and closed within a two-hour limit.

To carry out such an order would practically require 9,700 lease men, or one for each well because the order states the flowing time shall be between 7 and 9 a. m. This assumes that all wells will be flowing at the same time and under similar conditions. If these conditions are not approximated it is quite likely that any new proration order based upon this proposed test will be attacked in court as not founded upon equitable allowable to each well according to the well's capacity.

If the men are available to actually carry on this test there are other mechanical conditions unfavorable to its completion.

Well Equipment

Because of the fact that the greater portion of the wells in East Texas have been completed since proration orders have been placed upon the field there has been no reason for equipping each well to permit it to flow its capacity for even a short time.

If these wells will make an average of 75 bbls. per hour under open flow conditions it would produce 1,455,000 bbls. in the two-hour period. It is estimated by men familiar with the field that wells will make from 150 to 225 bbls. per hour which would raise this figure two or three times this amount. Even if there is 3,000,000 bbls. of storage on leases in the field it is not so distributed as to permit oil being delivered to it at this rate.

The wells are equipped with various kinds of flow strings, some made up of one size of tubing from top to bottom, others are tapered strings. This places unequitable flowing conditions on the various wells. Nearly all wells have adjustable beans at the tubing head for controlling rates of flow to conform to allowables. Some have bottom hole beans which cannot be changed for the test. Under conditions of open flow the surface adjustable beans would be opened to their full capacity.

The wells are usually so connected with the oil and gas separators as to permit producing the oil through the tubing or through the annular space between tubing and casing, or both. While the order states that the tests shall be made by flow through tubing only there will be no way to determine if this provision has been strictly followed or whether the wells have been permitted to flow through the space between tubing and casing.

The oil and gas separators that have been installed on the East Texas leases have been selected for a capacity equal to the flow rate for one or two wells but in many cases several wells are connected into the same trap. If all wells were opened at once the lease oil and gas separators would not have enough capacity to properly handle the oil and gas from all of them at once.

The battery of lease storage tanks has also been selected to handle only a limited amount of production per day and if the wells were all opened at once they would be quickly filled and the full capacity of the wells could not be determined.

Wells on the west edge are known to be close to water and many operators have registered objections to opening them to full capacity for even two hours because they fear that water would cone at the bottom of the well which might cut off production for some time, and perhaps permanently.

Probable Complications

Recognizing these many mechanical and physical conditions unfavorable to an open flow potential test of this kind but realizing that there is a possibility that new orders for well allowables issued based upon the data secured from such a test may be held to be valid it is only reasonable to assume that many operators will endeavor to arrange to get as large a flow from their wells as possible.

Some wells will not start to flow naturally after they have been shut in for some time and the gas has separated from the oil. The column of dead oil places such a pressure on the formation that the well cannot flow until it has been started by some mechanical means.

It may be that there are relatively few wells that are of this type but it seems only natural that their owners would consider that they are being penalized by this open flow order and they would therefore start the wells flowing in advance of the appointed time and have them producing into a tank not set aside for the test. At the start of the test the flow would be switched to the test tank and the two-hour flow made into it. This would not be fair to other wells for a well tested under such a condition would really be taking its potential under settled flowing conditions.

While affidavits covering all conditions of the test are required by the commission there will not be enough inspectors available to check conditions even in a small degree. Considering the attitude taken by some operators toward commission orders in the past it seems safe to assume that this one will not receive any better treatment.

While open flow methods of taking well potentials might have been applied to this field early in its history it seems hardly possible to resort to this method now. The order issued early in December, 1932, based upon the Buck formula is considered valid under the conditions as laid down by the various courts. If it had been enforced much trouble might have been avoided, and it does seem that some order based upon bottom-hole pressures and acreage can still be formulated and held valid by the courts because it is known that there is a direct relationship between pressure drop and rate of production in this field.

order, and has been allowed to produce 74 bbls. per well instead of from 30.8 to 42 bbls. per well. Other injunctions will also be filed against the commission if it retains its present order. The Rowan & Nichols company endeavored to get the commission to write an order allocating production on an acreage basis, or give proper consideration to acreage.

Locations and Completions

There were only 20 locations staked in the field this week, and 29 wells were completed. Wildcat locations reached a new peak when seven new tests were announced. Two wildcat tests were abandoned. The locations are spread over Henderson, Anderson, Hill, Angelina, Hopkins, Morris and Van Zandt Counties. The location in Van Zandt County was staked in the newly opened Nacatoch sand area north of the Van Pool. This will be the second test in this area, the first test just completed producing 35 bbls. of oil per day from the 1,250-foot sand.

Interesting Wildcats

Perhaps one of the most interesting of the seven new wildcat locations is McElreath and Suggett's No. 1 T. E. Scott in the Cleveland Robb Survey, Henderson County. This is approximately 1¼ miles southeast of the town of Murchinson and a dry hole formerly drilled in the northwest corner of the Elijah Pine Survey. This test went to 3,946 feet. Acreage for this new test was obtained from the Humble Oil & Refining Co. and Gulf Production Co., the owners also picking up more acreage from others. The area has been thoroughly tested by core drilling. The test drilled by the Shell Petroleum Corp. about three years ago on its LaRue block near the town of that name is approximately 13 miles due south of the McElreath and Suggett location.

An interesting shallow test in Van Zandt County is to be drilled by C. A. Burton and others on the E. R. Tunnell tract formerly held by the Pure Oil Co. This tract is in the H. Wright Survey, the location being approximately 1¼ miles north of the first Nacatosh producer, which was tested last week.

Abandonments

American Liberty Oil Co.'s No. 1 H. B. Greggs in the Spivey Survey, approximately 3½ miles north of Athens in Henderson County, marks off another interesting area. It was abandoned this week at a total depth of 4,638 feet. The Woodbine sand was topped at 4361 feet, but proved free of oil. Salt water was encountered at 4,478 feet. Elevation is 428 feet. The Texas State Oil Co. abandoned a test, 3,000 feet from the Greggs test, about two years ago. The former test went to 4,598 feet picking up showings of oil in sand at 4,403-07 feet.

The abandoned Wood County test went to 4,710 feet before it was given up as hopeless this week. The Wood County Oil & Gas Co. drilled this test on the Guy Davis farm in John Chetts Survey, approximately 2½ miles southeast of Yantis. Elevation is 443 feet.

Wildcatting in East Texas has been somewhat slack, but with the staking of seven locations appearances are much brighter for a resumption of wildcatting activities.

COMPLETIONS IN EAST TEXAS

Atlantic Oil Production Co.'s No. 5-B Barnswell, top sand 3,450 feet, initial production 64 bbls. per hour through tapered tubing, total depth 3,595 feet. Bond & Dillard Drilling Co.'s No. 4 D. Moyers, top sand 3,540 feet, initial production 80 bbls. per hour through three-quarters-inch tubing choke, total depth 3,570 feet. Joe Edgar and others' No. 2 Stinchcomb, location abandoned. Lewis Godlin's No. 1 E. L. Walker, location abandoned. Gulf Production Co.'s No. 6 M. F. Barker, top sand 3,550 feet, initial production 80 bbls. per hour through three-quarters-inch tubing choke, total depth 3,596 feet. Humble Oil & Refining Co.'s No. 21 W. R. Hughes, top sand 3,659 feet, initial production 73 bbls. per hour through three-quarters-inch tubing choke, total depth 3,685 feet; No. 13 H. M. Lawrence, top sand 3,622 feet, initial production 70 bbls. per hour through three-quarters-inch tubing choke, total depth 3,652 feet; No. 5 W. C. Mackey, top sand 3,630 feet, initial production 25 bbls. per hour through half-inch tubing choke, total depth 3,641 feet. B. K. Isaacs' No. 2-B Harris, top sand 3,521 feet, initial production 60 bbls. per hour through 2-inch tubing choke, total depth 3,550 feet.

Magnolia Petroleum Co.'s No. 5 J. H. Beavers, top sand 3,548 feet, initial production 198 bbls. per hour through open tubing, total depth 3,554 feet; No. 13 Everett, top sand 3,684 feet, initial production 160 bbls. per hour through 1-inch tubing choke, total depth 3,687 feet. Massie and others' No. 5 Orr, top sand 3,553 feet, initial production 40 bbls. in one-quarter hour through three-quarters-inch tubing choke, total depth 3,589 feet. Ray Drilling Co.'s No. 6 Tubbs, top sand 3,542 feet, initial production 40 bbls. per day pumping, total depth 3,575 feet. Stanolind Oil & Gas Co.'s No. 12-C Flewellen, top sand 3,602 feet, initial production 19 bbls. in one-quarter hour through open tubing, total depth 3,630 feet. Yount Lee Oil Co.'s No. 5 J. G. McGrede, top sand 3,551 feet, initial production 73 bbls. per hour through eleven-sixteenths-inch tubing choke, total depth 3,571 feet.

South Gregg County

E. M. Jones' No. 1 L. D. Crim, top sand 3,551 feet, initial production 30 bbls. per day pumping, total depth 3,650 feet. C. H. Liner, Inc.'s No. 1 A. A. King, location abandoned. Magnolia Petroleum Co.'s No. 10 J. Radford, top sand 3,706 feet, initial production 105 bbls. per hour through 1-inch tubing choke, total depth 3,709 feet. Sun Oil Co.'s No. 3 A. G. Norton, top sand 3,471 feet, initial production 90 bbls. per hour through open tubing, total depth 3,491 feet. The Texas Company's No. 12 M. T. Cole, top sand 3,527 feet, initial production 85 bbls. per hour through open tubing, total depth 3,564 feet.

North Rusk County

Gulf Production Co.'s No. 2 H. Baton, top sand 3,569 feet, initial production 43 bbls. per hour through three-quarters-inch tubing choke, total depth 3,633 feet; No. 2 W. Oten, top sand 3,622 feet, initial production 43 bbls. per hour through three-quarters-inch tubing choke, total depth 3,715 feet. Humble Oil & Refining Co.'s No. 68 L. D. Crim, top sand 3,645 feet, initial production 95 bbls. per hour through three-quarters-inch tubing choke, total depth 3,660 feet; No. 1-B J. D. Florey, top sand 3,675 feet, initial production 72 bbls. per hour through three-quarters-inch tubing choke, total depth 3,704 feet; No. 20-A S. S. Laird, top sand 3,656 feet, initial production 50 bbls. per hour through three-quarters-inch tubing choke, total depth 3,688 feet; No. 19-B Sexton, top sand 3,658 feet, initial production 56 bbls. per hour through open tubing, total depth 3,742 feet. Kirby Petroleum Co.'s No. 6 J. Reddie, top sand 3,616 feet, initial production 75 bbls. per hour through 1-inch tubing choke, total depth 3,700 feet.

South Rusk County

Droppleman Drilling Co.'s No. 2 P. G. Warren, top sand 3,760 feet, initial production 50 bbls. in one-half hour through open 2-inch tubing, total depth 3,763 feet.

Rusk County

Humble Oil & Refining Co.'s No. 2 George Alexander, top sand 3,666 feet, top Georgetown lime 3,782 feet, bailed dry and abandoned, total depth 3,785 feet (T. H. Smith Survey); No. 18-A Plowman, top sand 3,650 feet, initial production 32 bbls. in one-half hour through three-quarters-inch tubing choke, total depth 3,697 feet; No. 16 J. W. Turner, top sand 3,704 feet, initial production 45 bbls. per hour through three-quarters-inch tubing choke, total depth 3,758 feet. The Texas Company's No. 6 Stone, top sand 3,661 feet, initial production 110 bbls. per hour through open 2-inch tubing, total depth 3,711 feet.

WILDCAT COMPLETIONS

Henderson County

American Liberty Oil Co.'s No. 1 H. Gregg, top Pecan Gap 2,470 feet, base Pecan Gap 2,587 feet, top Austin chalk 3,508 feet, base Austin chalk 3,922 feet, top sand 4,395 feet, top red beds 4,515 feet, top Woodbine sand 4,361 feet, dry and abandoned, total depth 4,638 feet, John Spivey Survey, elevation 428 feet.

Wood County

Wood County Oil & Gas Co.'s No. 1 Guy Davis, top Austin chalk 4,150 feet, base Austin chalk 4,265 feet, dry and abandoned, total depth 4,710 feet, John R. Chetts Survey, elevation 443 feet.

East Central Texas Wildcats

Week Ending March 27

ANDERSON COUNTY

Company, well, farm name, section and block—	Remarks
Barclay et al's No. 1 J. C. Beard, 150 ft. out of most westerly NE cor. of 178-ac. lease, J. Trimmer Sur.	S.D. 2,004 ft.

ANGELINA COUNTY

Crosbie et al's No. 1 John C. Davis, 150 ft. from N of center of tract and survey, John H. Graham Sur.	S.D. 1,195 ft.
H. C. Jennings et al's No. 1 Colmorgan, 150 ft. from N line and 1,300 ft. from E line of 200-ac. tract, 4 miles N of Lufkin, J. Messingill Sur.	S.D. 999 ft.

CHEROKEE COUNTY

Hooper et al's No. 1 Doctor Overton, 330 ft. from N and E lines of tract and 330 ft. out of most easterly NE cor. of survey, Wesley Dikes Sur.	Prepare to set csg.; T.D. 3,656 ft.
L. J. Hopcroft et al's No. 1 J. R. Taylor, 2,600 ft. from E line and 2,000 ft. from S line of survey, G. M. Doherty Sur.	Derrick.
Loring Oil Co.'s No. 1 F. M. Swearingen, 330 ft. from S and E lines of 68-ac. tract, 2,800 ft. from W line and 330 ft. from S line of survey, Oliver Lund Sur., 1 mile SW of Maydelle	Coring 5,116 ft.; drill stem test at 5,116 ft.; showed 1,700 ft. salt water in 15 minutes.
Mid-Tex Oil Co.'s No. 1 A. Pace (formerly Clopton), 288 ft. from N line and 330 ft. from most northerly E line of 40-ac. lease, Wesley Dikes Sur.	T.D. 3,665 ft.; swabbed 98 per cent salt water; S.D.
Wilson & Stubbs' No. 1 L. Robert, 450 ft. from S and 150 ft. from W line of lease, J. B. Wolfin Sur.	Prepare to deepen; T.D. 3,600 ft.

ELLIS COUNTY

Paris Oil Co.'s No. 1 O. S. Bain, 1,500 ft. from S line and 300 ft. from W line of 60-ac. lease, R. M. Williams Sur.	Drlg. 987 ft.

FANNIN COUNTY

Lauther Kenn et al's No. 1 Steren, center of survey, 3 miles SW of Ladonia, John Wills Sur.	S.D. 1,384 ft.

FRANKLIN COUNTY

Whitecak Oil Co.'s No. 1 O. C. Clanton, 750 ft. from S line of survey and 150 ft. from W line of survey, S. McCreary Sur.	Drlg. 2,860 ft.

FREESTONE COUNTY

Clyde Creighton's No. 1 Holley Bros., 554 ft. from W line and center of N and S lines of lease, A.B.M. Sur.	Drlg. 4,507 ft.

GREGG COUNTY

Bay Oil Corp.'s No. 5 J. M. Wheeler, 150 ft. due N of Pelphrey Bros.' No. 1 Wheeler, D. Ferguson Sur.	Derrick.
E. & F. Oil Co.'s No. 2 M. Jackson, 330 ft. from S line and center of E and W lines of 16.66-ac. lease, G. F. Penn Sur.	Derrick.
Faith Oil Co.'s No. 4 J. C. Barrett, B. W. Witcher Sur.	Rig up and S.D.
F. V. Hughes' No. 1 S. Carr, 520 ft. from S line, 1,500 ft. from W line of M. McCurry Sur.	Rig up.
Lion Oil & Refining Co.'s No. 2 Evans, S offset to Sinclair Prairie's No. 10 Williams, P. McAnnelly Sur.	Derrick.
Manzeill et al's No. 2 Walker, 520 ft. from N line, 1,450 ft. from E line of M. Dillard Sur., Blk. 54	Rig up.
McWhorter, receiver's No. 2 Nellie Jobe, 462 ft. from S line and 312 ft. from E line of lease in P. W. Warraner Sur.	Drlg. 2,645 ft.
J. C. Means' No. 4 W. D. Luce, SW offset to Blue Star's No. 2-G, E. L. Walker Sur.	Drlg. 1,100 ft.
B. F. Phillips' No. 1 League, 281 ft. N and 356 ft. E of NE cor. of Mabee's Whitehurst lease in H. F. Rogers Sur.	Waiting on cmt. to set 3,608 ft.
Rajo Oil Co.'s No. 2 Barrett, 378 ft. from N line and 330 ft. from W line of lease, B. W. Witcher Sur.	Derrick.
Ray Drilling Co.'s No. 2 Tubbs, 150 ft. from W line of lease in D. Sanches Sur.	Top Pecan Gap 2,439 ft.; drlg. 2,940 ft.
Reserve Pet. Co.'s No. 2 Godfrey, 161 ft. from most northerly S line, 318 ft. from most easterly W line of Sheeks Bates lease, M. V. Winkle Sur.	Drlg. 2,050 ft.
Sun Oil Co.'s No. 3 A. G. Norton, 330 ft. from W line of lease and 660 ft. S of No. 2, S. Baggett Sur.	Waiting on cmt. to set 3,429 ft.
Swain-Holcomb & Hamilton, Blk. 125, 1,300 ft. from S line, 150 ft. from W line of Sur., H. R. Haket Sur.	Testing; T. D. 3,632 ft.
L. W. Tarkington's No. 1-A Mrs. A. M. Greggston, 187 ft. N of Johnston's No. 1 Greggston and center of N and S lines of lease, M. Dillard Sur.	Derrick.
W. & R. Oil Co.'s No. 1 S. A. Raven, 386 ft. from S line, 100 ft. from S line of Sur., D. Moore Sur.	Drlg. 2,707 ft.

HILL COUNTY

Mahon et al's No. 1 McGuffey, 620 ft. from S and 150 ft. from E line of 200-ac. tract, 4 miles NE of Mount Calm, F. & N. Scrutchfield Sur.	Drlg. 1,100 ft.

(Continued on Next Page)

Nine Wells in Hebron Field, Pennsylvania, Large Gas Producers

CORNING, N. Y., Mar. 25.—The Sylvania Corp.'s No. 1 Phelps in Hebron Township, Potter County, Pennsylvania, was completed Wednesday and its initial production has been variously rated from 9,000,000 to 20,000,000 feet per day. It is one of the best wells in the Hebron Field which now has a total open flow capacity of 110,000,000 feet from nine wells. The new well is an offset to a 20,000,000-foot gasser drilled by the Wyoga Gas Co. and was drilled on a 136-acre lease that is said to have cost the present owners $75,000. The top of the Oriskany sand was found at 5,163 feet.

There are four wells drilling in Potter County and two in Tioga County.

In the Geneva gas field in Ontario County, New York, Peterman & Ivers were rigging up on No. 1 Valerio, setting 8-inch surface pipe on No. 1 Skuse, and drilling at 500 feet in No. 1 Waterman, expecting to hit Niagara lime about April 5. The Great Northern Gas Co. is shut down at 900 feet on its test and the Geneva Gas Co. is waiting orders, with its well at depth of 2,860 feet. The Eylers Oil & Gas Co. of Louisiana is reported to have signed a contract to drill three wells south of the Waterman location of Peterman & Ivers.

DEATH OF E. F. CURTIS

Edwin Forest Curtis, of Olean, N. Y., oil producer, age 63 years, died on March 15. He was stricken with illness and died while on his oil property at Rock City, N. Y., in the north end of the Bradford Field, and his body was found by a pumper.

East Central Texas Wildcats

(Continued from Preceding Page)

Spikes et al's No. 1 Holman, 150 ft. from NW cor. of 100-ac. tract, one-half mile S of Mt. Calm, Latham Sur. ..... Rig up.

HOPKINS COUNTY

Burgess and Sinson's No. 1 First Natl. Bank, 470 ft. N and W of SE cor. D. Buie Sur., but located in the H.E.P.&P.R.R. Sur. ..... Drlg. 2,470 ft.

E. P. Corley's No. 1 Jumper ..... Moving in rig; T.D. 1,630 ft

Culberson & Lynch's No. 1 Louis Stribling, 150 ft. from NW cor. of tract and lease, Thomas Norris Sur. .. Rig up.

Hager & Ashby's No. 1 H. Smith, 1,320 ft. from S line and 915 ft. from W line of 418-ac. tract, J. A. Croft Sur. ..... Set surface csg. 81 ft.

HUNT COUNTY

Johnson & Russell et al's No. 1 N. A. Pregarg, 150 ft. from W line, 500 ft. from S line of 30-ac. tract, 3 miles E of Campbell, Wm. Glass Sur. ..... Drlg. 1,335 ft.

KAUFMAN COUNTY

Bixy-Bentley-Brewer et al's No. 1 J. B. Hunter, 300 ft. from S line and 150 ft. from SE line of 500-ac. tract, 4 miles S of Terrell, R. Sowell Sur. ..... T.D. 65 ft.; waiting on cmt.

LIMESTONE COUNTY

C. C. Curtis et al's No. 1 Emma Daniels, 150 ft. from W line and 150 ft. from S line of 42.5-ac. tract in Pedro Varela Sur. ..... Drlg. 360 ft.

Miller Drilling Co. and Joiner's No. 1 J. A. Stephenson, 400 ft. from S line and 300 ft. from E line of lease, one-fourth mile SE of Kosse, Charles Welch Sur. .... T. D. 3,140 ft.; S. D.

NAVARRO COUNTY

R. B. Godding et al's No. 1 Lela Kolt, 450 ft. from E line and center of N and S lines of lease, 3 miles NE of Chatfield ..... Spudded and S.D.

RED RIVER COUNTY

Ajo Oil Co.'s No. 1 Nickels & Daniels, center of S 780 acres of 1,808-ac. tract, 8 miles N of English, Hugh B. Shaw Sur. ..... Bldg. derrick.

Concord Oil Co.'s No. 1 J. R. Dallahunty, 500 ft. from N of Isaac Moore Sur. and 300 ft. E of E line of Robert Glass Sur. ..... S.D. 1,849 ft.; shale.

RUSK COUNTY

Brawn, receiver's No. 1 Lide, center of 4-ac. lease, S. P. Hollingsworth Sur. ..... Drlg. 40 ft.

A. P. Gary's No. 3 Redwine, center of Blk. No. 9, in Juan Ximenes Sur. ..... Prepare to run csg.; T.D. 3,636 ft.

Griffin & Barnes' No. 1 fee, 13 ft. from S and W lines of 5-ac. tract, J. B. De Cadena Sur. ..... Set surface csg

Hathaway et al's No. 1 Gray, J. M. McLain Sur. ..... S.D. 4,000 ft.

H. B. W. Oil Co.'s No. 3 Redwine, 150 ft. from E line and center of Payne's No. 1 Redwine, Juan Ximenes Sur. ..... Derrick.

Jordan & Ramsey's No. 1 L. W. Prior, 330 ft. from N line and 607 ft. from E line of 53-ac. lease, Walker Pettit Sur. ..... Rig up.

Kimble & Acre's No. 1 Frederick, 150 ft. from S line and center of E and W lines of 10-ac. lease, Juan Ximenes Sur. ..... Derrick.

Malone et al's No. 1 J. S. Williams, 330 ft. from S line and 330 ft. from SE line of lease, Jessie Crawford Sur. ..... Reaming down 3,700 ft.

Olson Bros.' No. 5 J. T. Brown, 300 ft. from N line and 700 ft. from W line of lease, M. J. Pru Sur. .... Derrick.

Parks et al's No. 1 Frederick, 4,400 ft. from W line and 450 ft. from N line of Juan Ximenes Sur. .... Waiting on cmt. to set; T.D. 3,465 ft.

E. L. Pinkston's No. 1 L. J. Pinkston, center of a 1-ac. lease, F. Cardova Sur. ..... Spudding.

Ross Seward's No. 1 Burton, J. J. T'Darbo Sur. ..... T.D. 3,387 ft.

Smith and Sikes' No. 2 W. H. Frederick, 150 ft. from S and E lines of 10-ac. lease, Juan Ximenes Sur. .... Rig up to pump; T.D. 3,675 ft.

Snyder et al's No. 3 Stewart, 174 ft. NW of No. 1 at 190 ft. SE of C. L. Archer's No. 1 J. H. Stewart, John Womack Sur. ..... Derrick.

Stanolind and Pure Oil Co.'s No. 3 W. H. Siler, 150 ft. from N line and 215 ft. from W line of W. B. Perry Sur. ..... Bldg. road.

Sun Oil Co.'s No. 7 R. J. Hendon, 330 ft. from N line of lease, 665 ft. from No. 2 and No. 5 Juan, Ximenes Sur. ..... Drlg. 2,879 ft.

SMITH COUNTY

Long Drilling Co.'s No. 3 G. A. Turner, D. W. Campbell Sur. ..... Derrick.

M. M. Rowan et al's No. 1 Gibbons Mfg. Co., 5,000 ft. from S line and 5,050 ft. from W line of survey .... S.D. 3,610 ft.

Sneed et al's No. 1 Church Lot, S offset to Wilford's No. 1 Cook in Juan Vargas Sur. ..... T.D. 2,750 ft.

The Texas Company's No. 7-B Jarvis, 330 ft. from W line and 1,320 ft. from N line of lease, M. D. L. S. Coy Sur. ..... Drlg. 2,950 ft.

Thayer & Maddox' No. 1 W. P. Rushing, 330 ft. from N line and center of E and W lines of tract in Jacob Herrin Sur., 1½ miles SE of Whitehouse ..... Drlg. 2,635 ft.

TITUS COUNTY

Randua Newberry et al's No. 1 First State Bank, 1,391 ft. from S and 3,410 ft. from E line of James T. Box Sur. ..... Derrick.

UPSHUR COUNTY

W. C. Bentley's No. 1 Brawley heirs, 630 ft. E and 170 ft. N of NW cor. of Sun's Hargraves lease, M. Mann Sur. ..... Waiting on cmt. to set 3,678 ft.

Magnolia Petroleum Co.'s No. 13 H. Hampton, 650 ft. from S line and 330 ft. from W line of lease ..... Waiting on cmt. to set; T.D. 3,641 ft.

Magnolia Petroleum Co.'s No. 14 H. Hampton, 330 ft. from E line and 660 ft. N of No. 11 well in D. Ferguson Sur. ..... Waiting on cmt. to set; T.D. 3,707 ft.

George Pace et al's No. 1 D. C. Shelton, N offset to C. L. Brown's No. 1 D. C. Shelton, William King Sur. ..... Drlg. 2,040 ft.

Travis & Weir's No. 1 L. P. League, 330 ft. from N line and 330 ft. from W line of N 12 acres of L. P. League Sur. ..... Waiting on cmt. to set 3,641 ft.

Wadley and Evans' No. 1 W. S. Jones, 330 ft. from S and E lines of 100-ac. lease, James M. Dunn Sur. ... T.D. 3,690 ft.; swabbed salt water; swabbing.

Waggoner & McConnell's No. 4 Williams, 300 ft. from W line and center of N and S lines of 12-ac. lease, McKinley & Williams Sur. ..... T.D. 3,630 ft.; tested salt water; cmtd. back to 3,620 ft.; S.D.

VAN ZANDT COUNTY

Golf Oil Co.'s No. 1 Gillentine, 150 ft. from S and E lines of E 4 acres of 42-ac. tract in Nacogdoches County School Land Sur. ..... Rig up.

Manning & Collins' No. 1 Mrs. Mollie High, center of 5-ac. tract, 2 miles NW of Myrtle Springs in William H. Bunch Sur. ..... Derrick.

Peden-Olson's No. 1 W. S. Brannon, 305 ft. from N and 140 ft. from W lines of 45-ac. tract, 2½ miles N of John Goodman Sur. ..... T.D. 1,250 ft.; pumped and flowed 36 bbls. first 12 hours.

Pure Oil Co.'s No. 3 D. O. Mayo, 200 ft. N of S line and 325 ft. E of W line of D. O. Mayo 39.5-ac. tract, J. Prado Sur. ..... Set surface csg.

Pure Oil Co.'s No. 7 L. M. Brawner, 970 ft. N of most southerly S line and 250 ft. E of most easterly W line of L. M. Brawner 147.9-ac. tract, John Walling Sur. ..... Set surface csg.

Pure Oil Co.'s No. 5 J. A. Bracken, 250 ft. S of N line and 325 ft. W of E line of 69-ac. tract in John Walling Sur. ..... Setting liner; T.D. 2,946 ft.

Pure Oil Co.'s No. 2 R. M. Butler, 150 ft. from N and 793 ft. from W lines of 69.16-ac. tract in David Ross Sur. ..... Moving in rotary.

Roy Stumpff's No. 1 M. I. Riggs, 169 ft. from E line and 250 ft. from S line of tract No. 2 and 330 ft. from E line of lease, 4 miles NE of Van, William Daniel Sur. ..... Waiting on cmt. to set 120 ft.

Van Oil Association's No. 1 Tankersley, 200 ft. from E and 1,000 ft. from S of farm, L. Landers Sur. ..... T.D. 2,850 ft.; skid 50 ft. W and set 10-in. csg. at 181 ft.; waiting on cmt.

WOOD COUNTY

Hull & Short's No. 1 T. H. Peterson, 400 ft. from S line and 300 ft. from E line of 320-ac. tract and survey, 4 miles E of Mineola, W. B. McNutt Sur. ..... Drlg. 3,039 ft.

Wildcat Operations in West Texas

(Continued from Page 91)

GARZA COUNTY

F.H.E. Oil Co.'s No. 1 Stoker ..... T.D. 2,909 ft.

GLASSCOCK COUNTY

R. T. Holms' No. 1 Hilger, 330 ft. from N line and 330 ft. from E line of Sec. 15, Blk. 34, Twp. 3s; T.&P. Sur. ..... Rigging up machine.

Lawson's No. 3-B Edwards, 330 ft. from S and W, Sec. 16, Blk. 33, Twp. 2s, T.&P. Sur. ..... Fishing; T.D. 2,780 ft.

HOWARD COUNTY

M. D. Bryant et al's No. 1 L. C. Denman, 3,310 ft. from S and W lines of Sec. 10, Blk. 30, Twp. 1s, T.&P. Sur. ..... Fishing 615 ft.

Eppenauer et al's No. 1 Leatherwood, C of SE of NW, Sec. 35, Blk. 33, Twp. 1n, T.&P. Sur. ..... Moving in material

F.H.E. Oil Co.'s No. 1 Dodge, 330 ft. from N and E, Sec. 15, Blk. 31, Twp. 1s, T.&P. Sur. ..... T.D. 2,867 ft.; plugged back to 2,801 ft.; top pay 2,758 ft.; cleaning out.

Merrick-Lamb's No. 6 Chalk, 1,650 ft. from N line and 330 ft. from W line of Sec. 125, Blk. 29, W.&N.W. Sur. ..... Drlg. 150 ft.

Mid-Continent Pet. Co.'s No. 2 Denman, 330 ft. from S and E of Sec. 10, Blk. 30, Twp. 1s, T.&P. Sur. ..... Spudded.

Myers et al's No. 1 Denman, 2,305 ft. from S and 2,320 ft. from E, Sec. 14, Blk. 30, Twp. 1s, T.&.'. Sur. .... Cmtd. 8¼-in. csg. 1,504 ft.

Mid-Continent Oil & Gas Co.'s No. 1 Denman, 990 ft. from S and 330 ft. from E, Sec. 10, Blk. 30, Twp. 1s, T.&P. Sur. ..... T.D. 2,813 ft; putting on pump.

Sinclair Prairie Oil Co.'s No. 4 Dodge, 960 ft. from S and 330 ft. from W, Sec. 11, Blk. 30, Twp. 1s, T.&P. Sur. ..... T.D. 2,826 ft.; swabbed 125 bbls. first 24 hrs. after shot.

Sinclair Prairie Oil Co.'s No. 5 Dodge, 2,310 ft. from N and 330 ft. from W, Sec. 11, Blk. 30, Twp. 1s, T.&P. Sur. ..... Drlg. 2,567 ft.

Southern Oil Corp.'s No. 1 Williams, 430 ft. from N and 330 ft. from W of S 123 acres of W half Sec. 43, Blk. 30, Twp. 1s, T.&P. Sur. ..... S.D. 2,653 ft.

Jack Wallace et al's No. 1 Scott, 990 ft. from N and 330 ft. from E lines of Sec. 93, Blk. 29, W.&N.W. Sur. ..... Ran 10-in. csg. 585 ft.

IRION COUNTY

Bristow et al's No. 2 Nutt, 2,550 ft. N, 1,000 ft. W, Sec. 4, Gonzales County School Lands Sur. ..... T.D. 600 ft.; to drill ahead.

Straughn et al's No. 1 Kaiser, 1,930 ft. from N and 1,390 ft. from W, Sec. 69, H. Cooper Sur. ..... Fishing 1,110 ft.

JONES COUNTY

Cender Pet. Co.'s No. 1 Holt, 1,900 ft. from S and 1,800 ft. from W, Sec. 4, Blk. 36, T.&P. Sur. ..... Cellar.

Dyer's No. 1 Odom, 200 ft. from S and 170 ft. from W of N 320 acres, G. Zumwalt Sur. ..... Moving in tools.

Johnson's No. 1 Huddleston, 165 ft. from S and W of N half of N half of Sec. 89, Blk. 18, T.&P. Sur. ..... T.D. 2,585 ft.; waiting on 6-in. csg.

Shaheen Oil Co.'s No. 1 Sandlin, 1,320 ft. from S and E lines of Sec. 3, in Mrs. Louisa Matthews Sur. No. 7. Spudded.

Smart & Reynold's No. 1 Reynolds, 2,500 ft. from N and 150 ft. from W, Sec. 3, W. T. Scott Sur. No. 3... Fishing 1,474 ft.

Southern Oil Co.'s No. 1 Swann, 1,000 ft. from E and 900 ft. from S. of I. Miley Sur. ..... Drlg. 2,320 ft.

LOVING COUNTY

A. & M. Pet. Corp.'s No. 1 Wheat, 2,310 ft. SW, 990 ft. SE, Sec. 71, Blk. 1, W.&N.W. Sur. ..... Cellar.

Eppenauer Drlg. Co.'s No. 1-A Victor, 330 ft. from SW and 338 ft. from SE of NW of N half Sec. 4, Blk. 2, W.&N.W. Sur. ..... Rigging up standard tools.

Goldman et al's No. 2 Allen, 330 ft. from NW, 2,310 ft. from SW, Sec. 90, Blk. 1, W.&N.W. Sur. ..... Rig.

Goldman et al's No. 1 Reagan-McElvain, 330 ft. from NE, 2,310 ft. from NW, Sec. 84, Blk. 1, W.&N.W. Sur.. Cellar.

Martin et al's No. 1 Wheat, 990 ft. from SW and SE, Sec. 32, Blk. 1, W.&N.W. Sur. ..... Drlg. 4,100 ft.

Miller et al's No. 1 Ferguson, 990 ft. from NE of Sec. 44, Blk. 29 ..... Spudded and S.D.

Thomas' No. 1 Wheat, 2,310 ft. from NW, 990 ft. from NE, Sec. 88, Blk. 1, W.&N.W. Sur. ..... T.D. 4,050 ft.; trying to straighten hole.

PECOS COUNTY

Bennett et al's No. 1 Powell, 330 ft. from SW and SE, Sec. 76, Blk. 10, H.&G.N. Sur. ..... Drlg. 1,200 ft.

California Co.'s No. 2 Tippett, 475 ft. W and 1,296 ft. N from SW cor. of Sec. 2, Robinson Sur. ..... T.D. 1,440 ft.; T.P. 1,409 ft.; may use acid.

Cardinal Oil Co.'s No. 3-G Tippett, 660 ft. from S and 330 ft. from E of No. 3 Tippett, Sec. 61, Blk. 194, G.C.&S.F. Sur. ..... T.D. 393 ft.

Cardinal Oil Co.'s No. 16 E. Tippett, 5,280 ft. from S and 150 ft. from W of E half of W half Sec. 48, Blk. 194, G.C.&S.F. Sur. ..... T.D. 550 ft.; pumps 20 bbls. fluid day, 7 per cent water.

Cochran et al's No. 1 Pecos Valley Co., 1,650 ft. from SE and SW lines of Sec. 34, Blk. 3, H.&T.C. Sur. .... Drlg. 500 ft.

Humble Oil & Ref. Co.'s No. 1 White-Baker Co., 1,320 ft. from N and E lines of Sec. 44, Blk. Z, T.C.R.R. Sur. ..... Drlg. 300 ft.

Massey's No. 1 Iowa Realty Trust, 150 ft. from NE and 1,483 ft. from NW, Sec. 21, Blk. 10, H.&G.N. Sur. .... S.D. 435 ft.

McClure et al's No. 1 Pecos Valley, 330 ft. from NW line and 330 ft. from NE line of Sec. 34, Blk. 3, H.&T.C. Sur. ..... Rigged up and S.D.

Wahlenmaier et al's No. 1 Monroe, 6,000 ft. W and 330 ft. N from SE cor. of Sec. 41, Blk. 1, L.&G.N. Sur. ... Rigged up spudder.

Winfield et al's No. 1 Eaton, 1,170 ft. from NE and 2,490 ft. from SE, Sec. 35, Blk. 3, H.&T.C. Sur. ..... T.D. 1,627 ft.; shot 80 qts. from 1,593-1,623 ft.; flowed 74 bbls. first 24 hrs.

REAGAN COUNTY

Big Lake Oil Co.'s No. 1-C University ..... S.D. 9,563 ft.

Big Lake Oil Co.'s No. 8-C University, 710 ft. from S and 2,410 ft. from E, Sec. 13, Blk. 2 ..... T.D. 3,300 ft.; flowed 2,596 bbls. and 25,250,000 ft. gas.

Big Lake Oil Co.'s No. 9-C University, 2,410 ft. from N and 765 ft. from E, Sec. 13, Blk. 2 ..... Drlg. 6,870 ft.

Continental Oil Co.'s No. 6-B University, 765 ft. from N and 1,980 ft. from W. Sec. 36, Blk. 9 ..... T.D. 3,344 ft.; flowed 2,670 bbls. and 11,000,000 ft. gas.

Big Lake Oil Co.'s No. 10-C University, 2,625 ft. from S and 375 ft. from W, Sec. 25, Blk. 9 ..... Drlg. 2,022 ft.
Continental Oil Co.'s No. 7-B University, 1,980 ft. from N and 660 ft. from W, Sec. 36, Blk. 9 ..... Drlg. 5,899 ft.
Continental Oil Co.'s No. 8-B University, 1,300 ft. from S and 1,775 ft. from W, Sec. 36, Blk. 9 ..... Drlg. 5,670 ft.
J. P. Williams et al's No. 1 Scott, 1,650 ft. from N and 330 ft. from W, Sec. 179, Blk. 1, T.&P. Sur. ..... Drlg. 1,032 ft.

REEVES COUNTY

Cordova Union Oil Co. et al's No. 1 Wright, 1,320 ft. from S and W. Sec. 58, Cassell's Sur. ..... T.D. 3,865 ft.; repairing rig.
Hugo Freels et al's No. 1 S. B. Greenman, 330 ft. from NE and 2,310 ft. from SE lines of Sec. 21, Blk. 2, H.&G.N. Sur. ..... Rigging up standard tools.

RUNNELS COUNTY

Dutton et al's No. 1 Dean, 5,475 ft. from NE and 1,048 ft. from NW in J. Heil Sur. No. 519 ..... S.O. 3,417-20 ft.; S.D. 3,600 ft.
John Castor's No. 1 Hall, 330 ft. from S and W, Sec. 149, E.T.R.R. Sur. ..... Spudded.

SCHLEICHER COUNTY

Eastland Oil Co.'s No. 1 Joe Tisdale, C Sec. 29, Blk. M, G.H.&S.A. Sur. ..... Drlg. 5,475 ft.
Wesner et al's No. 1 Nicks, 2,310 ft. from N and 2,303 ft. from E of Sec. 77, Blk. LL, T.C. Sur. ..... T.D. 6,250 ft.; straightening 6⅝-in. csg. from 4,137 ft.; T.D. 6,170 ft.

SCURRY COUNTY

M. E. Dibble et al's No. 1 Carruthers, 2,310 ft. from N and W lines of Sec. 121, Blk. 97, H.&T.C. Sur. ..... S.D. 240 ft.
Heinsleman et al's No. 1 Hood, 426 ft. from N and 489 ft. from E, Sec. 87, Blk. 3, H.&T.C. Sur. ..... Running csg. 1,150 ft.

STERLING COUNTY

Fullick & Johnson's No. 1 Davis, 990 ft. from S and 660 ft. from E, Sec. 7, Blk. 13, S.P. Sur. ..... S.D. 270 ft.

TAYLOR COUNTY

Urban's No. 1 Blair, 1,500 ft. from S and 150 ft. from W of NE 198 varas Guadalupe County School Lands, Lot 21 ..... Show oil and gas 2,216-31 ft.. S.D. 2,326 ft.

TERRELL COUNTY

Sides et al's No. 1 Phelps, 2,157 ft. from N and 3,462 ft. from W, Sec. 5, G. W. Hurley Sur. ..... S.D. 3,555 ft.

TOM GREEN COUNTY

Hancock et al's No. 1 Reed, 330 ft. N and 1,670 ft. W of SW cor. of C. Schoner Sur. but in Mason & Perry Subd. No. 39 ..... Drlg. 80 ft.
Pratt & Hancock's No. 2 Lewis, 100 ft. N and 330 ft. E of most northerly SW cor. of Joshua S. Grant Sur. No. 2 ..... S.D. 300 ft.

UPTON COUNTY

Gulf Prod. Co.'s No. 102 McElroy, 1,320 ft. from S and W, Sec. 189, Blk. F, C.C.S.D.&R.G.N.G. Sur. ..... Shot with 230 qts. from 2,857-2,925 ft.; last 24 hrs. after shot flowed 130 bbls. of oil; to run tubing; T.D. 2,931 ft.

WARD COUNTY

Abell Bros.' No. 2 Sloan, 990 ft. from NE and NW, Sec. 34, Blk. 5, H.&T.C. Sur. ..... S.D. 2,500 ft.
Atlantic-Penn's No. 3 Bennett, 330 ft. from SE line and 2,310 ft. from SW line of Sec. 16, Blk. 34, H.&T.C. Sur. ..... Drlg. 1,950 ft.
Atlantic Oil Prod. Co.'s No. 1 Johnson, 330 ft. from NW and 2,310 ft. from NE, Sec. 9, Blk. 34, H.&T.C. Sur.... Drlg. 2,278 ft.
Atlantic Oil Prod. Co.'s No. 2 Johnson, 990 ft. from NW and 2,310 ft. from NE, Sec. 9, Blk. 34 ..... Flowed 244 bbls. in 16 hrs. through tubing; T.D. 2,529 ft.
Atlantic Oil Prod. Co.'s No. 1 University, 330 ft. S and E, Sec. 3, Blk. 16 ..... Repairing derrick; T.D. 2,438 ft.
Atlantic Oil Prod. Co.'s No. 1 Blank-Camp, 1,320 ft. from NW and SW Sec. 14, Blk. 34, H.&T.C. Sur. ..... T.D. 2,884 ft., sand; 1,400 ft. sulphur water 26 hrs. 2,880-84 ft.; shot 120 qts. 2,705-2,730 ft.; no results; shot 80 qts. 2,590-2,630 ft.; flowed 36 bbls.; to run tubing.
Barnsdall Oil Co.'s No. 5 Henry, 1,650 ft. from NE and 330 ft. from SE, Sec. 28, Blk. B-29, P.S.L. Sur. ..... 25,000,000 ft. gas 2,114-28 ft.; T.D 2,185 ft.; S.D.
George Bentley et al's No. 1 C. Bergman, 330 ft. from NE line and 2,310 ft. from NW lines of Sec. 26, Blk. 5, H.&T.C. Sur. ..... Drlg. 410 ft.
George Bentley et al's No. 1 A. Emory, 1,650 ft. from NE line and 2,310 ft. from NW line of Sec. 36, Blk. 5, H.&T.C. Sur. ..... Drlg. 150 ft.
W. A. Black et al's No. 1 Ann B. Gordon, 990 ft. from NW and 330 ft. from NE lines of Sec. 6, Blk. 34, H.&T.C. Sur. ..... Drlg. 335 ft.
Bradford's No. 1 Beatty, 1,650 ft. from NW and 330 ft. from SW, Sec. 3, Blk. 34, H.&T.C. Sur. ..... S.D. 250 ft.
Bundy et al's No. 1 Bennett, 2,310 ft. from NW and SW Sec. 16, Blk. 34, H.&T.C. Sur. ..... Waiting on cement to set; T.D. 2,608 ft.
Eppenauer's No. 1 Purcell, 365 ft. from SW and 1,650 ft. from SE of Sec. 17, Blk. 14, H.&T.C. Sur. ..... T.D. 2,740 ft.; S.D.
Eppenauer Drlg. Co.'s No. 1 University, 350 ft. from N and 440 ft. from E of S half of Blk. 16 ..... Cellar.
Gerber O. & G. Co.'s No. 1 Stubbs, 330 ft. from S, 990 ft. from W, Sec. 9, Blk. 3, B.&B. Sur. ..... Cellar.
Graham Corp.'s No. 1 Bennett, 2,310 ft. from NE line and 330 ft. from SE line of Sec. 16, Blk. 34, H.&T.C. Sur. ..... Rigging up rotary.
H. V. Greer's No. 1 Carr, 150 ft. from NW and 510 ft. from SW, Sec. 12, Blk. 5, H.&T.C. Sur. ..... S.D. 2,323 ft.
Gulf Prod. Co.'s No. 14 Hutchings, 330 ft. from N and W of Sec. 9, Blk. O ..... Swabbing and cleaning out; T.D. 2,739 ft.
Gulf Prod. Co.'s No. 16 Hutchings, 1,932 ft. from S and 1,650 ft. from W, Sec. 5, Blk. F ..... Reaming 2,515 ft.
Gulf Prod. Co.'s No. 17 Hutchings, 330 ft. from W line and 1,151 ft. from S line of Sec. 5, Blk. A, G.&M.M.B.&A. Sur. ..... Bldg. rig.
Gulf Prod. Co.'s No. 29 O'Brien, 4,148 ft. from N line and 330 ft. from E line of Sec. 16, Blk. F, G.M.M.B.&A. Sur. ..... Moving in tools.
Moran et al's No. 1 Reynolds, 170 ft. from SE and SW of NW 80 of NE half Sec. 12, Blk. 5, H.&T.C. Sur. .. T.D. 990 ft.; cleaning out.
Prince Bros.' No. 2 Hall-Roberts, 1,470 ft. from NE and 2,300 ft. from NW, Sec. 14, Blk. 34, H.&T.C. Sur. .... S.D. 920 ft.; lost returns.
Rector Oil Co.'s No. 1 Monroe, 660 ft. from NE and SE, Sec. 42, Blk. 33, H.&T.C. Sur. ..... S.D. 4,150 ft.
Rector-Plains' No. 1 Monroe, 1,320 ft. from SE line and 330 ft. from NE line of Sec. 31½, James Ross Sur. No. S.F. 7,666 ..... Rigging up standard tools.
Rowan & Nichols' No. 1 Street, 990 ft. from SE and 330 ft. from NE, Sec. 17, Blk. 34, H.&T.C. Sur. ..... Drlg. 2,625 ft.
Southern Oil Co.'s No. 1 Sloan, 1,650 ft. from NE and 330 ft. from NW, Sec. 34, Blk. 5, H.&T.C. Sur. ..... Cleaning out 2,175 ft.
Stanolind Oil & Gas Co.'s No. 1 Whitlock, 495 ft. NE, 2,200 ft. SE, Sec. 14, Blk. 34, H.&T.C. Sur. ..... Waiting orders; T.D. 2,515 ft.
Strum-Simms' No. 3 Jones ..... Swabbing 100 bbls. oil per day; T.D. 2,616 ft.
Sturm et al's No. 4 Jones, 2,310 ft. from SW and 990 ft. from SE Sec. 25, Blk. B-29, P.S.L. Sur. ..... Preparing to run tubing; T.D. 2,591 ft.
G. R. Thomas et al's No. 2 John B. Bennett, 2,310 ft. from SE and 1,650 ft. from NE lines of Sec. 16, Blk. 34, H.&T.C. Sur. ..... Rigging up rotary.
Thompson's No. 1 Johnson, 2,310 ft. from SW and 330 ft. from NW, Sec. 9, Blk. 34, H.&T.C. Sur. ..... Flowing 50 bbls. oil per day with tools in hole; T.D. 2,351 ft.

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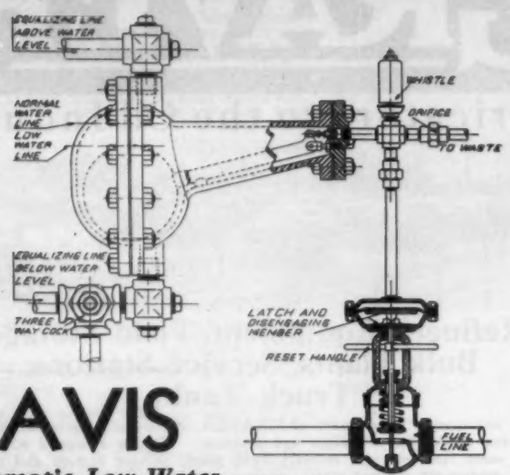

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WINKLER COUNTY

Colonial Oil Co.'s No. 1 State vacancy, 330 ft. E and 103 ft. N of NW cor. Sec. 2, Blk. 77, P.S.L. Sur. ..... Drlg. 2,820 ft.
Richardson et al's No. 1-B Scarborough, 990 ft. from S and 1,980 ft. from E, Sec. 18, Blk. 74, P.S.L. Sur. .... Fishing; T.D. 2,716 ft.

Wildcat Operations in Texas Panhandle

Week Ending March 27

CARSON COUNTY

Company, well, farm name, section and block—	Remarks:
Texas Interstate P. L. Co.'s No. 1 Burnett, 1,323 ft. N, 2,675 ft. E of N¼ Sec. 97, Blk. 5, L&G.N. Sur.	T.D. 2,527 ft; 14,000,000 ft. gas; rig burned.
Texoma Nat. Gas Co.'s No. 4-S Schaffer, 1,324 ft. S, 1,325 ft. E of SE Sec. 46, Blk. 4, L&G.N. Sur.	Digging cellar.
Texoma Nat. Gas. Co.'s No. 1 Gores, 1,320 ft. from S and 1,327 ft. from E lines of SE Sec. 43, Blk. 4, L&G.N. Sur.	Lowering csg. at 1,025 ft.
Union Pet. Co.'s No. 3 Cooper, 330 ft. N, 330 ft. E SE, Sec. 5, Blk. 9, L&G.N. Sur.	Cellar.

CHILDRESS COUNTY

G. V. McClintock et al's No. 1 B. F. Moore, C Sec. 47, F. P. Knott Sur.	Spud and S.D.
Massy & Peters' No. 1 O. L. Tucker, 150 ft. S and W lines of Sec. 4, F. P. Knott Sur.	Rig up standard tools.

COLLINGSWORTH COUNTY

Tittle, Cochran et al's No. 1 Boyles, 150 ft. S and E of Sec. 90, Blk. 14, H.&G.N. Sur.	Crooked hole 145 ft.

GRAY COUNTY

Back & Barber's No. 1 Back, 660 ft. from S, 330 ft. from W, Sec. 140, Blk. 25, H.&G.N. Sur.	S.D. 2,520 ft.
Baldridge et al's No. 1 Catlin, 330 ft. S and E of E 80 of 158-ac. tract, Sec. 57, Blk. 3, I.&G.N. Sur.	S.D. 3,171 ft. for connection.
Baldridge O. Co.'s No. 1-B Melton, 330 ft. from N and E of SW, Sec. 95, Blk. B-2, H.&G.N. Sur.	Drlg. 2,775 ft.
Gordan Burch's No. 1 Laugham, 990 ft. S, 330 ft. E Sec. 1, W¼ NE, Sec. 1, Blk. B-3, H.&G.N. Sur.	S.D. 2,660 ft.
Sam Danner's No. 1 Cobb, 330 ft. S and W NE, Sec. 165, Blk. 3, I.&G.N. Sur.	T.D. 3,384 ft; T.P. 3,345 ft; shot; 1,300 ft. oil in hole.
Dolomite Prod. Co.'s No. 1 Sailor, 330 ft. N and E, Sec. 111, Blk. 3, I.&G.N. Sur.	T.P. 3,133 ft; T.D. 3,230 ft; running csg.
Gray County Prod. Co.'s No. 1 Huselby, 330 ft. from S and W, E½ NW, Sec. 55, Blk. 25, H.&G.N. Sur.	T.D. 2,790 ft; pay 2,625-35 ft. and 2,755-76 ft; fishing.
Mazda-Shell's No. 4 Coombs-Worley, 990 ft. from N line 330 ft. from E line, Sec. 35, Blk. 3, I.&G.N. Sur.	Rig.
Ochiltree et al's No. 1 Hughey, 330 ft. S, 330 ft. E E half SE, Sec. 139, Blk. 3, I.&G.N. Sur.	T.D. 3,257 ft; T.P. 3,170 ft; shot with 100 qts. from 3,170-3,240 ft.; C.O.
Parton Holt's No. 4 Morse, 660 ft. from N and E of E half SW, Sec. 5, Blk. 26, H.&G.N. Sur.	S.D. 2,630 ft.
Saunders et al's No. 2 Sullivan, 332 ft. from W, 231 ft. from NE, 160 ft. S, 264 ac. of N½, Sec. 136, Blk. 3, I.&G.N. Sur.	Will plug back to 2,275 ft. and shoot.
Sinclair Prairie Oil Co.'s No. 1-E Combs-Worley, 330 ft. from S and E, Sec. 34, Blk. 3, I.&G.N. Sur.	Rig up standard tools at 2,910 ft.
Skelly Oil Co.'s No. 1 C. Thut, 330 ft. from S line, 330 ft. from W line, SW Sec. 1, H.&G.N. Sur., Blk. 1.	Drlg. 1,930 ft.
Skelly Oil Co.'s No. 1 Gething, 990 ft. from S and W of Sec. 48, Blk. 9-A, H.&G.N. Sur.	S.D. for P.L. connection; T.D. 2,716 ft.
Sun Oil Co.'s No. 1-B Combs-Worley, 330 ft. S and E of SW Sec. 34, Blk. 3, I.&G.N. Sur.	Coring 2,869 ft.
Tedesco-Bell O. & G. Co.'s No. 4 Morse, 990 ft. N and W SE, Sec. 1, Blk. 26, H.&G.N. Sur.	Drlg. 1,250 ft.
Paul Tharp's No. 1 Short, 330 ft. from N and W of Sec. 2, Blk. 1, H.&G.N. Sur.	T.P. 2,968 ft; T.D. 3,070 ft; S.D. for connection.
L. L. Travis et al's No. 1 Crossman, 990 ft. W, 330 ft. S of W½ Sec. 97, Blk. B-2, H.&G.N. Sur.	Drlg. 1,700 ft.
Sam Travis' No. 1 Back, 330 ft. S and E E half NE, Sec. 44, Blk. 25, H.&G.N. Sur.	Drlg. 2,250 ft.
Warner Oil Co.'s No. 1 Webb, 660 ft. from S and W of W 80 of N½ Sec. 42, Blk. 25	Spudding.
Weltzel Oil Co.'s No. 2 Morse, 330 ft. from S and E of N half NW, Sec. 67, Blk. 25, A.&G.N. Sur.	T.D. 2,675 ft.; plugged back to 2,285 ft.; to set csg.

HEMPHILL COUNTY

Hoover's No. 1 Hoover, 350 ft. from N, 1,300 ft. from E, G. S. Hood Sur.	T.D. 5,250 ft.; S.G. 5,245 ft.

HUTCHINSON COUNTY

Alexander's No. 1 Cockrell, 330 ft. N and E of E 80 of S 160, Sec. 3, Blk. M-2, T.C. Sur.	Prepare to shoot; est. 70 to 100-bbl. well before shot; T.D. 3,029 ft.
Danciger O. & R. Co.'s No. 1 Johnson, 330 ft. N and W, SE, Sec. 34, Blk. Y, A.&B. Sur.	Spudded and S.D.
Huber Pet. Co.'s No. 1 Moyer-Johnson, 990 ft. from N, 330 ft. from E half SW, Sec. 34, Blk. Y, A.&B. Sur.	Swbng. and testing; T.D. 3,032 ft.
Huber Pet. Co.'s No. 2-C Johnson, 990 ft. S, 330 ft. W lines of E½ SW Sec. 34, Blk. Y, A.&B. Sur.	Cellar.
Joe Murphy's No. 1 Watkins, 440 ft. from N and W of N half, Sec. 13, Blk. M-21	T.P. 2,923-60 ft; T.D. 2,964 ft; no test yet made.
Ryan Consolidated's No. 3 Johnson, tract No. 9, Mary Whitley Sur.	O.W.D.D.; T.D. 2,981 ft.
H. Steckol's No. 1 J. A. Whittenburg (Amerada), 430 ft. from S line, 990 ft. from W line, Sec. 37, T.C.R. R. Sur.	C.O. after 90-qt. shot from 2,962-96 ft; T.D. 2,998 ft.
H. Stekol's No. 4-D G. A. Whittenburg, 450 ft. from N line, 990 ft. from W line, Sec. 38, Blk. M-23, T.C. R.R. Sur.	Rig on ground.
Texlivania Oil Co.'s No. 1 Halle, 330 ft. S, 280 ft. W, Sec. 16, Blk. 1, E.L.R.R. Sur.	Drlg. 2,560 ft.

MOORE COUNTY

Canadian River Gas Co.'s No. 2-A Perkins, 3,350 ft. S of most northerly NE cor, 200 ft. W of E line, Sec. 54, Blk. 47, H.&T.C. Sur.	U.R. at 2,150 ft.
Shamrock Oil & Gas Co.'s No. 1 Burnett, 660 ft. from S, 330 ft. from W, Sec. 359, Blk. 44, H.&T.C. Sur.	Drlg. 4,375 ft.

ROBERTS COUNTY

Chicken Creek Oil Co.'s No. 1 Ledrick, 330 ft. N and W, Sec. 55, Blk. C, G.&M. Sur.	Recmtng. csg.; T.D. 4,980 ft.

WHEELER COUNTY

Delaney et al's No. 1 Sitter, 330 ft. from S and W of E half NE, Sec. 33, Blk. 24	Est. 15,000,000 ft. gas; S.D. 2,711 ft.
Devore & Robinson's No. 1 Sitter, 2,310 ft. from S and E, E½, Sec. 33, Blk. 24, H.&G.N. Sur.	Running rods and tubing; T.D. 2,760 ft.
Helena O. & G. Co. et al's No. 1 Below, C NE SW, Sec. 50	Drlg. 1,380 ft.
Osborne et al's No. 2 Sloss & Admire, 330 ft. from N line and 1,530 ft. from E line of NE Sec. 47, H.&T. C. Sur., Blk. 13	Drlg. 1,767 ft.
B. M. Rhodes' No. 1 Noel, 330 ft. S and E NE, Sec. 54, Blk. 24, H.&G.N. Sur.	Drlg. 2,425 ft; S.O. 2,400 ft. and 2,401-05 ft. and 2,417-25 ft.
Rogers & Harner's No. 1 J. O. Clark, 990 ft. S and W of Sec. 6, Blk. 24, H.&G.N. Sur.	Rig.

Bureau of Mines Statistics for the Month of January, 1933

RUNS TO STILLS AND OUTPUT OF REFINERIES, JANUARY, 1933

(Thousands of barrels of 42 U. S. gallons)

INPUT—	Crude oil: Domestic	Crude oil: Foreign	Crude oil: Total	Unfinished oils rerun	Natural gasoline	Total input
East Coast	10,655	2,752	13,407	651	120	14,178
Appalachian	2,655	.....	2,655	432	25	3,112
Ind., Ill., Ky., etc.	9,025	.....	9,025	235	162	9,422
Okla., Kans., Mo.	6,717	.....	6,717	430	372	7,519
Texas Inland	4,269	.....	4,269	119	275	4,663
Texas Gulf	12,485	13	12,497	412	273	13,182
Louisiana Gulf	2,674	30	2,704	111	15	2,830
Ark. and La. Inland	1,400	.....	1,400	257	40	1,697
Rocky Mountain	981	.....	981	105	84	1,170
California	12,438	.....	12,438	529	*896	13,863
Total	63,299	2,794	66,093	3,281	2,262	71,636

OUTPUT—	Gasoline	Kerosene	Gas oil and distillate fuels	Residual fuel oils	Lubricants	Wax (thousands pounds)
East Coast	5,529	959	1,001	4,039	602	19,880
Appalachian	1,417	245	239	441	342	6,720
Ind., Ill., Ky., etc.	4,701	276	821	1,530	145	1,120
Okla., Kans., Mo.	3,833	500	647	1,444	177	2,520
Texas Inland	2,387	200	251	1,358	24	280
Texas Gulf	5,186	1,115	1,690	3,059	342	4,480
Louisiana Gulf	1,155	368	369	560	32	1,960
Ark. and La. Inland	662	63	211	406	12	.....
Rocky Mountain	654	38	72	208	10	280
California	4,983	599	1,584	5,533	141	.....
Total	†30,508	4,363	6,885	18,578	1,827	36,680

OUTPUT (continued)—	Coke (tons)	Asphalt (tons)	Road oil	Still gas	Miscellaneous	Unfinished products	Shortage
East Coast	17,300	24,200	11	744	19	805	122
Appalachian	2,200	2,400	5	178	13	77	107
Ind., Ill., Ky., etc.	47,400	33,800	1	644	14	864	49
Okla., Kans., Mo.	18,200	1,100	28	266	5	260	251
Texas Inland	17,500	.....	...	94	5	66	366
Texas Gulf	31,600	11,400	2	795	4	542	207
Louisiana Gulf	4,900	4,900	1	101	20	55	110
Ark. and La. Inland	200	5,600	...	45	1	221	43
Rocky Mountain	12,700	.....	28	67	6	21	132
California	3,300	18,400	31	290	10	278	296
Total	94,900	101,800	107	3,224	97	3,189	1,683

*Includes 117,000 bbls. run through pipe lines. †Includes 410,000 bbls. special naphthas.

CRACKING OPERATIONS

Fresh cracking stock charged to stills, 30,494,000 bbls.; gasoline produced by cracking, 13,128,000 bbls.; fuel oil produced by cracking, 11,215,000 bbls.

SUPPLY AND DEMAND OF ALL OILS

(Including wax, coke, and asphalt in thousands of barrels of 42 U. S. gallons)

NEW SUPPLY:	Jan., 1933	Dec., 1932	Jan., 1932
Domestic:			
Crude petroleum	63,998	58,044	66,884
Daily average	2,064	1,872	2,158
Natural gasoline	2,898	2,888	3,342
Benzol*	95	96	115
Total production	66,991	61,028	70,341
Daily average	2,161	1,969	2,269
Imports:			
Crude petroleum	2,831	2,746	2,047
Refined products	1,175	1,164	3,550
Total new supply, all oils	70,997	64,938	75,938
Daily average	2,290	2,095	2,450
Decrease in stocks, all oils	4,134	10,083	590
DEMAND:			
Total demand	75,131	75,021	76,528
Daily average	2,424	2,420	2,469
Exports:			
Crude petroleum	1,937	2,154	1,592
Refined products	6,316	4,621	7,030
Domestic demand	66,878	68,246	67,906
Daily average	2,157	2,201	2,191
Excess of daily average domestic production over domestic demand	4	†232	78
STOCKS (end of month):			
Crude petroleum:			
East of California	296,054	299,378	326,603
California‡	39,297	39,340	42,431
Total refinable crude	335,351	338,718	369,034
Natural gasoline‡	3,198	3,203	2,967
Refined products‡	245,489	246,251	259,145
GRAND TOTAL STOCKS ALL OILS	584,038	588,172	631,146
Days' supply	241	242	256
Bunker oil (included above in domestic demand)	2,702	2,751	3,031

*Based upon production of coke reported to Coal Division by those by-product coke plants that recover benzol products. †Deficiency. ‡California heavy crude and residual fuel included under refined products. §Includes motor blends held at natural gasoline plants.

NUMBER OF WELLS COMPLETED IN THE UNITED STATES*

	Jan., 1933	Dec., 1932	Jan., 1932
Oil	639	793	642
Gas	78	88	125
Dry	266	319	197
Total	983	1,200	964

*From The Oil and Gas Journal and California office of the American Petroleum Institute.

RECORD OF WELLS FOR IMPORTANT FLUSH FIELDS, JANUARY, 1933*

	Completions: Oil	Gas	Dry	Total initial prod. (bbls.)	Aver. initial prod. (bbls.)	Drilling Jan. 31
Texas	453	13	136	776,300	1,700	885
East Texas†	253	...	10	607,200	2,400	151
Gulf Coast	90	1	25	138,100	1,500	175
West Texas	21	2	1	6,100	300	125
California	12	...	9	6,400	500	98
Kettleman Hills	...	...	...	.....	.....	14
Long Beach	2	...	1	400	200	24
Playa del Rey	...	...	2	.....	.....	3
Oklahoma	46	3	42	31,600	700	339
Oklahoma County	8	...	2	22,400	2,900	24
Pottawatomie and Seminole Counties	1	...	4	700	700	36
New Mexico	5	...	...	36,700	7,300	57
Lea County (Hobbs)	4	...	...	36,600	9,200	11
Other states	123	62	79	19,100	200	862
Total United States	639	78	266	870,100	1,100	2,212

*From The Oil and Gas Journal and California office of the American Petroleum Institute.
†Initial production for the East Texas Field calculated from field reports.

COMPARATIVE ANALYSES

(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933: Total	Jan., 1933: Dy.av.	Dec., 1932: Total	Dec., 1932: Dy.av.	Jan., 1932: Total	Jan., 1932: Dy.av.
CRUDE PETROLEUM:						
Runs to stills: Domestic	63,299	2,042	63,257	2,041	65,371	2,109
Foreign	2,794	90	2,741	88	3,344	108
Total	66,093	2,132	65,998	2,129	68,715	2,217
Imports	2,831	91	2,746	89	2,047	66
Exports	1,937	62	2,154	69	1,623	52
MOTOR FUEL:						
Production	30,998	1,000	31,755	1,024	33,487	1,080
Imports	.....	....	56	2	1,224	39
Exports*	2,514	81	1,953	63	3,422	110
Stocks: Gasoline	51,712	....	49,865	....	56,598	....
Stocks: Natural gasoline	3,198	....	3,203	....	2,967	....
Domestic demand	28,442	853	27,191	877	26,063	841
KEROSENE:						
Production	4,363	141	4,097	132	3,798	123
Imports	.....	....	.....	....	.....	....
Exports	887	29	646	21	1,214	39
Stocks	4,794	....	4,974	....	5,304	....
Domestic demand	3,656	118	3,149	102	2,612	84
GAS OIL AND FUEL OIL:						
Production	25,463	821	24,471	789	26,460	854
Transfers†	1,102	36	827	27	445	14
Imports	1,141	37	1,085	35	2,302	74
Exports	2,095	68	1,332	43	1,586	51
Stocks	127,359	....	129,971	....	132,960	....
Domestic demand	28,223	910	29,054	937	30,517	984
LUBRICANTS:						
Production	1,827	59	1,625	52	2,092	67
Imports	.....	....	.....	....	3	....
Exports	547	18	453	15	616	20
Stocks	8,796	....	8,375	....	9,551	....
Domestic demand	859	28	1,042	34	1,413	46
WAX (thousands of pounds):						
Production	36,680	1,183	35,000	1,129	43,680	1,409
Imports	3,548	114	4,171	135	4,586	148
Exports	21,459	692	21,600	697	22,989	741
Stocks	160,240	....	163,628	....	178,082	....
Domestic demand	22,157	715	34,384	1,109	18,435	595
COKE (short tons):						
Production	94,900	3,061	149,600	4,826	144,900	4,674
Stocks	1,235,800	....	1,320,200	....	1,460,000	....
ASPHALT (short tons):						
Production	101,800	3,284	140,900	4,545	131,100	4,229
Imports (natural)	3,500	113	600	19	1,000	32
Stocks	272,200	....	276,100	....	309,400	....
ROAD OIL:						
Production	107	3	129	4	154	5
Stocks	573	....	564	....	460	....
STILL GAS:						
Production	3,224	104	3,314	107	3,207	103
MISCELLANEOUS:						
Production	97	3	315	10	244	8
Stocks	440	....	456	....	650	....

*Includes benzol—19,249 bbls. in January, 1933.
†Includes crude used as fuel and net transfers to fuel oil stocks.

PRODUCTION OF CRUDE PETROLEUM

(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933: Total	Jan., 1933: Dy.av.	Dec., 1932: Total	Dec., 1932: Dy.av.	Jan., 1932: Total	Jan., 1932: Dy.av.
Arkansas	942	30	922	30	983	32
California:						
Kettleman Hills	1,795	58	1,845	60	1,868	60
Long Beach	2,125	69	2,179	70	2,415	78
Santa Fe Springs	1,694	55	1,731	56	2,024	65
Rest of State	8,846	284	8,840	285	9,225	297
Total California	14,460	466	14,595	471	15,532	501
Colorado	88	3	84	3	114	4
Illinois	297	9	289	9	431	14
Indiana:						
Southwestern	48	2	49	2	69	2
Northeastern	1	....	2	....	3	....
Total Indiana	49	2	51	2	72	2
Kansas	2,933	95	2,642	85	2,954	95
Kentucky	438	14	453	15	498	16
Louisiana:						
Gulf Coast	1,036	33	1,022	33	879	29
Rest of State	876	29	840	27	791	25
Total Louisiana	1,912	62	1,862	60	1,670	54
Michigan	447	14	515	17	471	15
Montana	169	5	172	5	175	6
New Mexico	1,003	32	856	28	1,170	38
New York	253	8	262	8	322	11
Ohio:						
Central and Eastern	273	9	279	9	292	9
Northwestern	86	3	79	2	84	3
Total Ohio	359	12	358	11	376	12
Oklahoma:						
Oklahoma City	3,221	104	2,227	72	3,739	120
Seminole	3,404	110	3,306	107	3,900	126
Rest of State	5,857	189	6,282	202	6,160	199
Total Oklahoma	12,482	403	11,815	381	13,799	445
Pennsylvania	974	32	981	32	1,062	34
Tennessee	1	....	.....	....	1	....
Texas:						
Gulf Coast	3,814	123	3,834	124	3,276	106
West Texas	4,960	160	5,048	162	5,391	174
East Texas	10,447	337	5,306	171	9,854	318
Rest of State	6,665	215	6,738	218	7,216	233
Total Texas	25,886	835	20,926	675	25,737	830
West Virginia	294	9	296	9	333	11
Wyoming:						
Salt Creek	666	22	602	19	727	23
Rest of State	344	11	362	12	457	15
Total Wyoming	1,010	33	965	31	1,184	38
Total United States	63,998	2,064	58,044	1,872	66,884	2,158

PRODUCTION OF MOTOR FUEL

(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933: Total	Jan., 1933: Daily av.	Dec., 1932: Total	Dec., 1932: Daily av.	Jan., 1932: Total	Jan., 1932: Daily av.
Refinery gasoline:						
Straightrun	15,113	488	15,312	494	16,250	524
Cracked	13,128	424	13,686	441	14,179	457
Natural gasoline:						
Production	2,898	93	2,888	93	3,342	108
Deduct losses	241	8	227	7	399	13
Benzol	95	3	96	3	115	4
Total motor fuel	30,998	1,000	31,755	1,024	33,487	1,080

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STOCKS OF CRUDE PETROLEUM
(Thousands of barrels of 42 U. S. gallons)

EAST OF CALIFORNIA:	Jan. 31,	Dec. 31,	Jan. 31,
At refineries by location:	1933	1932	1932
East Coast: Domestic	7,602	7,604	8,078
Foreign	4,851	5,405	3,157
Appalachian	2,247	2,250	2,001
Indiana, Illinois, Kentucky, Michigan	3,780	3,529	3,940
Oklahoma, Kansas and Missouri	4,470	4,589	5,523
Texas: Inland	1,565	1,490	1,711
Gulf Coast: Domestic	5,871	5,882	6,438
Foreign	71	83	142
Louisiana Gulf Coast: Domestic	3,804	3,298	481
Foreign	1,094	1,116	2,427
Arkansas and inland Louisiana	566	445	749
Rocky Mountain	12,178	12,211	1,952
Total	47,100	47,902	36,594
At refineries by origin:			
Pennsylvania Grade	3,134	2,107	1,776
Other Appalachian (inc. Kentucky)	610	623	664
Lima-NE Indiana-Michigan	475	209	215
Illinois-SW Indiana	118	104	147
N. Louisiana and Arkansas	2,222	2,340	1,497
West Texas and SE New Mexico	4,282	3,873	3,567
Oklahoma, Kansas, N. Texas, etc.	14,778	15,568	17,630
Gulf Coast	4,333	4,410	5,292
Rocky Mountain	13,133	13,164	1,758
Foreign	6,016	6,604	4,048
Total	47,100	47,902	36,594
Pipe line and tank farm:			
Pennsylvania Grade	4,719	4,858	5,017
Other Appalachian (inc. Kentucky)	938	903	1,040
Lima-NE Indiana-Michigan	958	1,069	1,644
Illinois-SW Indiana	11,240	11,210	9,950
N. Louisiana and Arkansas	11,398	11,662	15,739
West Texas and SE New Mexico	31,411	33,072	34,282
Oklahoma, Kansas, N. Texas, etc.	155,435	155,893	179,108
Gulf Coast	11,513	12,130	13,423
Rocky Mountain	15,703	15,579	23,394
Total	243,304	245,376	283,607
Total refinery, pipe line and tank farm	290,404	293,278	320,201
Producers'	5,650	6,100	6,462
Total crude east of California	296,054	299,378	326,663
CALIFORNIA: Light	39,297	39,340	42,431
Total refinable crude in the United States	335,351	338,718	369,094

SHIPMENTS FROM CALIFORNIA TO EASTERN PORTS IN THE UNITED STATES*
(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933	Dec., 1932	Jan., 1932
Gasoline	570	445	495
Natural gasoline	81	73	73
Kerosene	405	104	...
Gas oil and Diesel oil	730	430	...
Fuel oil	73	...	...
Lubricants	...	8	2
Asphalt	...	...	1
Miscellaneous	16	1	1
Total	1,865	1,061	572

*Compiled by E. T. Knudsen of the San Francisco office of the Bureau of Mines.

PRODUCTION OF CRUDE PETROLEUM BY FIELDS
(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933		Dec., 1932		Jan., 1932	
FIELD:	Total	Dy.av.	Total	Dy.av.	Total	Dy.av.
Appalachian:						
Pennsylvania Grade	1,651	53	1,671	54	1,885	60
Other (inc. Kentucky)	582	19	600	19	650	21
Lima-N. E. Indiana-Michigan	534	17	596	19	553	18
Illinois-S. W. Indiana	345	11	338	11	500	16
Mid-Continent:						
N. Louisiana and Arkansas	1,819	59	1,762	57	1,774	57
West Texas-S. E. New Mexico	5,939	191	5,868	189	6,528	211
Other (Okla., Kans., N. Tex., etc.)	33,527	1,050	26,501	855	32,823	1,091
Gulf Coast	4,850	156	4,856	157	4,155	134
Rocky Mountain	1,391	42	1,257	40	1,506	49
California	14,460	466	14,595	471	15,532	501
Total	65,998	2,044	58,044	1,872	66,884	2,158

INDICATED DOMESTIC DEMAND FOR CRUDE PETROLEUM
(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933		Dec., 1932		Jan., 1932	
Domestic petroleum by fields of origin:	Total	Dy.av.	Total	Dy.av.	Total	Dy.av.
Appalachian:						
Pennsylvania Grade	1,768	57	1,742	56	1,681	54
Other (inc. Kentucky)	560	18	572	19	824	27
Lima-N. E. Indiana-Michigan	382	12	730	23	520	17
Illinois-S. W. Indiana	301	10	182	6	315	10
Mid-Continent:						
N. Louisiana and Arkansas	3,130	68	2,553	82	3,236	104
West Texas-S. E. New Mexico	6,175	199	6,454	208	7,405	239
Other (Okla., Kans., N. Tex., etc.)	34,349	1,105	33,233	1,072	34,030	1,098
Gulf Coast	5,535	179	5,466	177	3,754	121
Rocky Mountain	1,139	36	877	28	1,343	43
California	13,432	433	14,667	473	15,000	484
Total demand	65,767	2,119	66,485	2,144	68,108	2,197
Exports	1,937	62	2,154	69	1,592	51
Domestic demand	63,770	2,057	64,311	2,075	66,516	2,146
Foreign petroleum	3,419	110	2,300	74	2,493	80
Total domestic demand	67,189	2,167	66,611	2,149	69,009	2,226

GASOLINE PRODUCTION BY THE VARIOUS METHODS—JANUARY, 1933
(Thousands of barrels of 42 U. S. gallons)

	Straightrun			Cracked			Nat. gasoline		Gasoline	
		Pct.			Pct.			Pct.		Pct.
	Total	(*)	(†)	Total	(*)	(†)	Total	(†)	Total	(*)
East Coast	2,552	19.0	46.1	2,857	21.3	51.7	120	2.2	5,529	40.3
Appalachian	648	24.4	45.7	744	28.0	52.5	25	1.8	1,417	53.4
Ind., Ill., etc.	2,177	24.1	46.3	2,563	28.3	50.2	162	3.6	4,701	50.3
Okla., Kans., Mo.	1,977	29.4	51.6	1,484	22.1	38.7	372	9.7	3,833	51.6
Texas inland	1,487	34.5	61.5	845	15.1	37.0	275	11.6	2,387	49.5
Texas Gulf	2,176	17.4	41.0	2,737	21.9	52.8	273	5.3	5,186	39.3
Louisiana Gulf	621	23.0	53.8	519	19.2	44.9	15	1.3	1,155	42.3
Ark. & La. inland	324	22.1	48.9	299	21.4	45.1	40	6.0	663	44.5
Rocky Mountain	390	30.6	45.9	270	27.5	41.3	34	12.8	654	58.1
California	2,876	23.1	57.7	1,211	9.5	24.3	896	18.0	4,983	32.9
Total	15,113	23.9	49.6	13,123	19.8	43.0	2,262	7.4	30,508	42.7

*Per cent of crude run. †Per cent of total gasoline output.

SHIPMENTS OF MOTOR FUEL BY PIPE LINES
(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933	Dec., 1932	Jan., 1932
Motor fuel turned into lines	2,416	2,231	2,128
Motor fuel delivered from lines	2,437	2,479	1,886
Shortage	5	7	7
Stocks in lines and working tanks end of month	1,172	1,196	1,192

PRODUCTION AND DISTRIBUTION OF NATURAL GASOLINE
(Thousands of barrels of 42 U. S. gallons)

	Jan., 1933		Dec., 1932		Jan. 1932	
	Total	Daily av.	Total	Daily av.	Total	Daily av.
Production	2,898	93	2,898	93	3,342	108
Decrease in all stocks	5	.....	.....	.....	.....	.....
Total	2,903	93	2,898	93	3,342	108
Blended at refineries	2,145	69	2,154	70	2,279	73
Blended at plants east of Calif.	5	.....	7	.....	3	.....
Run through pipe lines in Calif.	117	4	102	3	118	4
Jobbers, exports, etc.	395	12	250	8	400	13
Increase in all stocks	.....	.....	145	5	143	5
Losses	241	8	227	7	399	13
Total	2,903	93	2,888	93	3,342	108

STOCKS HELD BY REFINING COMPANIES, JANUARY 31, 1933
(Thousands of barrels of 42 U. S. gallons)

	Gasoline					Residual
	At refineries	Bulk and pipe lines*	Total	Kerosene	Gas oil and distillate fuels	fuel oils
East Coast	5,097	8,191	13,288	854	2,912	4,920
Appalachian	1,486	567	2,053	230	†524	265
Ind., Ill., Ky., etc.	4,185	3,063	7,248	465	1,738	1,675
Okla., Kans. and Mo.	3,835	1,288	5,123	371	1,119	2,206
Texas inland	1,799	141	1,940	84	304	2,584
Texas Gulf	5,642	271	5,913	972	1,837	4,785
Louisiana Gulf	1,236	443	1,679	302	742	1,727
Ark. and La. inland	255	57	312	24	127	446
Rocky Mountain	1,379	.....	1,379	195	135	303
California	12,777	(‡)	12,777	1,297	3,242	195,765
Total	37,691	14,021	51,712	4,794	12,683	114,676
	Wax (thousands of pounds)					Coke
	Lubricants	Crude scale	Refined	Total		(tons)
East Coast	2,742	22,480	18,480	40,960		20,500
Appalachian	1,165	18,888	2,466	21,354		7,900
Ind., Ill., Ky., etc.	1,004	21,985	1,446	23,431		79,500
Okla., Kans., Mo.	640	1,868	1,105	2,973		141,900
Texas inland	90	.....	187	187		111,800
Texas Gulf	1,975	2,451	10,413	12,864		594,000
Louisiana Gulf	96	24,596	3,176	27,772		64,600
Ark. and La. inland	10	.....	.....	.....		.....
Rocky Mountain	193	28,112	2,587	30,699		109,700
California	881	.....	.....	.....		195,900
Total	8,796	120,380	39,860	160,240		1,225,800
	Asphalt (tons)	Road oil	Miscel. products	Unfinished oils		Natural gasoline
East Coast	88,600	98	61	7,105		127
Appalachian	9,100	24	27	†1,814		5
Ind., Ill., Ky., etc.	72,300	22	125	6,428		39
Okla., Kans., Mo.	4,300	110	17	3,385		26
Texas inland	.....	14	5	973		3
Texas Gulf	5,300	11	12	11,009		212
Louisiana Gulf	22,000	7	4	1,960		.....
Ark. and La. inland	25,100	.....	5	436		5
Rocky Mountain	2,700	109	5	2,251		6
California	42,900	178	179	18,079		2,230
Total	273,200	573	440	42,443		2,653

*Comparable figures for January 31, 1932, and December 31, 1932, as follows:

	Jan. 31	Dec. 31		Jan. 31	Dec. 31
East Coast	9,506	8,048	Texas Gulf	284	337
Appalachian	475	592	La.-Gulf	204	351
Ind., Ill., etc.	2,918	3,396	Ark-La., inland	187	99
Okla.,-Kans.	1,411	1,304			
Texas inland	180	144	Total U. S.	15,165	14,261

†176,000 bbls. of gas oil and distillate fuels transferred to unfinished stocks January 1. ‡Included with "at refineries." §Includes heavy crude. ¶Includes 4,540,000 bbls. topa.

SUMMARY OF STATEMENTS MADE MARCH 10, 1933, RELATING TO BUSINESS OF VARIOUS PIPE LINES FOR MONTH ENDING FEBRUARY 28, 1933

	Runs from Gross stocks	Other wells	Regular receipts	Other deliveries	deliveries
Nat. Transit	551,400.64	182,312.95	395,064.71	525,991.40	110,159.32
S W Pa. P. L.	323,362.67	53,663.73	581,509.63	321,153.15	307,908.07
Eureka P. L.	1,042,465.15	206,913.51	148,781.29	119,265.69	196,729.71
Buckeye P. L. (Macksburg)	267,680.02	203,874.92	147,035.57	256,855.10	106,271.59
Buckeye P. L. (Lima, etc.)	2,321,978.33	57,981.09	1,822,738.30	1,338,854.77	631,178.23
Buckeye P. L. (Cleveland)	35,556.35	8,716.59	236,236.61	1,462.52	253,972.93
Indiana P. L.	470,809.19	1,855.84	1,182,819.58	898,950.00	350,691.44
Southern P. L.	187,628.85	.....	39,706.29	.....	8,994.05
Bradford Trans.	305,235.11	241,197.34	.....	302,580.22	.....
N. Y. Transit	33,683.97	28,852.51	138,440.09	177,999.97	.....
Northern P. L.	312,109.04	.....	257,607.99	3,208.87	274,423.06
Tide Water P. L.	979,708.23	20,970.06	.....	423,538.54	.....
Tuscarora Dev.	9,501.05	.....	.....	191,325.21	.....
Valvoline P. L.	115,498.09	57,400.61	5,000.00	23,566.17	15,967.66
Total Feb. 28	6,906,418.89	1,163,239.15	4,954,940.06	4,635,751.61	2,156,295.81
Total Jan. 31	7,047,300.23	1,320,441.93	6,592,590.99	5,478,689.16	3,341,712.59
Difference	140,881.34	157,202.78	1,637,650.93	842,937.55	1,185,416.78

Russian Oil Production Compared in 1913 and 1931

R. N. Fridman, vice chairman of Russian Oil Products, which has the sole right to sell Russian oil products in the British Empire, addressing a London meeting, said the output of Russian crude oil increased from 9,200,000 tons in 1913 to 13,700,000 tons in 1928-29, and to 22,200,000 tons in 1930-31. The number of wells under exploitation amounted to 2,689 in 1923-27, and by 1931 it rose to 5,855. The output of oil during 1931 from wells drilled previous to the Soviet regime amounted only to 1,000,000 tons, while the production from new wells in the same year was 21,200,000 tons. Previous to the great war there were no plants in Russia producing petrol from gas, but by 1931 the production of petrol by that method was 108,000 tons.

Exploitation drilling in 1913 amounted to 275,000 meters; by 1925-26 it rose to 304,000 meters, and in 1931 it reached 448,000 meters. Exploratory drilling amounted to 3,000 meters in 1924-25, rising to 25,000 meters in 1926-27, and to 138,000 meters by 1931.

Refining in Russia in 1913 was only 5,700,000 tons, but by 1928-29 it had reached 11,000,000 tons, and 20,200,000 tons by 1932. The home consumption of oil products in Russia was also increasing, from 5,900,000 tons in 1913 to 12,500,000 tons in 1931. The export figures, too, showed the following great increases: 1913, 947,000 tons; 1928-29, 3,628,000 tons; 1929-30, 3,758,000 tons; rising to 5,224,300 tons in 1931 and over 6,000,000 tons last year, this being an increase of 451 per cent, as compared with 1913.

MILEAGE TAX ON TRUCKS

WASHINGTON, D. C., Mar. 27.—A bill was introduced by Mr. Boland in the House of Representatives which proposes mileage taxes for all interstate buses and trucks operated "for hire" over any public highway within the United States. The taxes would be either 2 or 3 cents per mile dependent upon either passenger or property carrying capacity. This tax would, of course, be in addition to all state levies now imposed upon the same vehicles.

Delayed Oklahoma City Allowables Made Up Resulting in Largely Increased Production

By W. A. SPINNEY
Staff Correspondent, Oklahoma Fields

Oklahoma's daily production showed a gain in the week ending March 25, of approximately 107,000 bbls. a day over the previous week. Estimated daily average for the seven days was 563,900 bbls. A large part of the gain was from the Oklahoma City Field which showed an average of 250,690 bbls. a day, or 96,690 bbls. over the 154,000-bbl. daily allowable fixed on March 1. Since then increases have been allowed to make up back allowables, and extra allowables were granted when the field was re-opened on March 14.

A townsite drilling campaign is expected to develop at Sasakwa, in southern Seminole County, where the Stanolind Oil & Gas Co.'s No. 1 Palmer, in NW cor. Section 36-6-7, is being completed. A location has been made for Ramsey Petroleum Corp. and Navajo Oil & Gas Co.'s No. 1 Martin, SE cor. SW NW Section 18-1-5w, Stephens County, which, it is expected, will be drilled to 6,500 feet. No previous tests have been drilled below 2,100 feet in the area.

Another interesting development has started in south central Payne County around the location of the Stanolind Oil & Gas Co. and Amerada Petroleum Corp.'s No. 1 Bowden, SE cor. NE SW Section 15-18-3. These companies own the entire section and all of Section 10-18-3, except the S half NE and N half SE, which is held by the Gypsy Oil Co. Considerable trading in leases and royalties has been taking place.

In northern Caddo County, near Binger, the Denver Producing & Refining Co.'s No. 1 Noe, NW cor. SW Section 34-10-10w, has landed and cemented 9-inch casing at 6,250 feet, and was drilling below 6,600 feet.

Phillips Petroleum Co.'s No. 1 Cordin, SW cor. NW NE SE Section 22-11-3w, in the Oklahoma City Field, made 494 bbls. of oil the first hour through a 4-inch choke. The gas was estimated at 80,000,000 feet per day, from Wilcox sand at 6,433-91 feet. It was the only well completed in the Oklahoma City Field during the week.

Will Prospect Buried Ridge

An interesting wildcat test was announced during the week along the buried mountain range that runs north and south from Oklahoma City to the Kansas state line. Many believe that this territory will yield considerable oil in the future.

A block of 1,440 acres in Township 15-4w, in Logan County, has been unitized, consisting of the E half Section 10, the SE Section 3, the S half Section 2, and all of Section 11. The companies interested in the drilling of the well include the Shell Petroleum Corp., Gypsy Oil Co., Sinclair Prairie Oil Co., E. R. Ramsey, Sunray Oil Co., The Texas Company, and the Phillips Petroleum Co.

A location was made in the C SE NW Section 11-15-4w, after a seismograph survey of the area.

Other companies owning acreage surrounding this block include Shell Petroleum Corp., Gypsy Oil Co., Anderson-Prichard Oil Corp., Magnolia Petroleum Co., Amerada Petroleum Corp., Slick estate, Sinclair Prairie Oil Co., and Producers & Refiners Corp.

Sinclair Prairie Oil Co.'s No. 1 Jerome, SW cor. Section 15-20-2w, southwestern Noble County, was fishing around 4,150 feet. Stanolind Oil & Gas Co.'s No. 1 Bolay, C SW NW Section 16-20-2w, was drilling around 4,000 feet. Two tests are active on the Community block in Township 20-2w, Lucien Consolidated Community's No. 1 Whitton, C SE SE Section 7-20-2w, was drilling around 900 feet, and No. 1 Farr, C NE NE Section 19-20-2w, was rigging.

Western Wildcats

An interesting well is the wildcat test of the Continental Oil Co. and others, No. 1 Thompson, NW cor. SW SW, Section 7-24-4w, Garfield County, near the townsite of Hunter. Acreage in this township has been closely held for several years. Several years ago an intensive check was made with a seismograph and a well was drilled in Section 32-24-4w, by the Shell Petroleum Corp. which found only showings of oil and gas in the Wilcox sand. A part of this acreage was then surrendered, but it has been leased again, some of the leases being for 5 and 10 years.

About a year ago the Mid-Continent Petroleum Corp. renewed its lease on the NW Section 8-24-4w, and the Continental Oil Co. on the NE Section 7-24-4w. The Continental Oil Co. also has community leases on almost the entire townsite of Hunter.

No. 1 Thompson found the Tonkawa sand at 3,867-85 feet and was drilling below 4,000 feet. The Tonkawa sand logged high.

The Tex-O-Kan Oil Co.'s No. 1 Acre, NE cor., Section 14-24-11w, a wildcat test in Alfalfa County, was cleaning out and fighting a cave at 5,400 feet while the total depth of the well is 5,502 feet.

Interest in the Naval Reserve area of Osage County, was revived during the week. Galt-Brown Co.'s No. 2, NE cor. SW NE, Section 30-24-8w, just east of the reserve, started making 3 bbls. of oil an hour from 2,414-48 feet.

In Keokuk Falls Area

Carter Oil Co. and others' No. 1 Keokuk Community, CNL NW NE, Section 2-10-6, Seminole County, was shut in after making around 24,000 bbls. of oil from the Misener sand at 4,090-4,106 feet. The last day the well was on production it gauged 2,009 bbls.

The same companies made a location for a north offset to the discovery well, C S half SW SE, Section 36-11-6. Barnsdall Oil Co.'s No. 1 Deere, SW cor. NW NW, Section 36-11-6, was drilling on Saturday at 2,600 feet.

The Oklahoma Corporation Commission has classified this area as a wildcat, and has limited the wells to 50 bbls. of oil per day.

Stanolind Oil & Gas Co. and others' No. 1 Palmer, NW cor., Section 36-6-7, near the townsite of Sasakwa, in Seminole County, increased its production with deeper drilling during the week and made 882 bbls. one day while drilling. The last reported total depth of the well is 3,977 feet in Simpson sand. This area has also been classed as wildcat and wells will be limited to 50 bbls. per day.

Failure East of St. Louis Pool

The east extension area to the St. Louis Pool, in Pottawatomie County, proved disappointing when the Wood Oil Co. and others' No. 1 Ashby, SW cor. NE NW, Section 22-7-5, found water in the Wilcox sand at 4,241-51 feet. This well was drilled about a mile east of the production in the St. Louis Pool.

In the West Holdenville Field

Location has been made for Pringle & Marshall's No. 1 Whiteley, SW cor. SE, Section 29-8-9, Hughes County, 3½ miles east of the townsite. A well was drilled in the NE cor., Section 29-8-9, that had an initial production of 500 bbls. a day several years ago.

In the West Holdenville area, G. M. Buchner has taken over the Chapman lease in the SE SE, Section 10-7-8, and a well will be drilled in the southwest corner of the lease at once.

Sunray Oil Co. has taken over the Hicks and Robinson interests, NW NW, Section 15-7-8, and started No. 3 Jacobs, NW cor., Section 15-7-8.

The Mid-Continent Petroleum Corp. has started construction work on about 5 miles of 4-inch pipe line to connect the Calvin sand wells in the West Holdenville Pool, in Sections 10, 11, 14, 15 and 22-7-8.

The water encroachment in the West Holdenville Pool has been remedied and the operators have improved the gas situation and there is now very little gas blowing into the air, except the residue from the gasoline plants of Crosbie & Moran and the Phillips Petroleum Co. Practically all the operators are now producing their wells under back pressure which is reducing the gas volume and is retarding the encroachment of water. Some of the wells are being reconditioned in attempts to halt the water.

Wells completed in the West Holdenville Field show a large amount of gas in the top of the sand and the oil is found in the bottom. The lack of a market demand for the gas has been a disturbing factor and since the increase in nominations for crude oil it has been a problem to fix a gas-oil ratio that was satisfactory to all the operators.

Phillips Petroleum Co.'s No. 2 Jacobs, in Section 16-7-8, a recent completion, has been making around 20 bbls. of oil an hour against a back pressure of 550 pounds.

Deep Test in Southern Oklahoma

In southern Oklahoma a location for a 6,500-foot test was announced during the week. It was Anderson & Kerr's No. 1 Payne, SE cor. SW NW, Section 18-1-5w, in Stephens County. The test is near a block of acreage Ramsey Brothers have assembled and the Lone Star Gas Co. also has lease interests in the vicinity. The location is along the Cruse structure

Wildcat Operations in Oklahoma

Northern Oklahoma

ALFALFA COUNTY

Company, farm and location—	Remarks:
Acre et al's No. 1 Acre, C SW NE Sec. 14-24-11w	O.W.D.D.; T.D. 5,502 ft; C.O.

CADDO COUNTY

Denver P. & R. Co.'s No. 1 Noe, NW SW SW Sec. 34-10-10w	Drlg. 6,667 ft.

CREEK COUNTY

Sinclair Prairie Oil Co.'s No. 1 Tibe, SW SE NW Sec. 29-14-7	Drlg. Wilcox 4,194-4,227 ft; show heavy oil.
O. O. Owen's No. 1 fee, NW cor. Sec. 23-15-7	Wilcox 3,992-98 ft; wtr.; S.D.

GARFIELD COUNTY

Continental Oil Co.'s No. 1 Thompson, NW SW SW Sec. 7-24-4w	Drlg. 4,401 ft.

HUGHES COUNTY

Redwine et al's No. 1 Ellis, C NW NW Sec. 9-5-11	Drlg. 1,000 ft.

KAY COUNTY

Blauner et al's No. 1 Maple, NE NW SE Sec. 20-27-4	Rigging.

KIOWA COUNTY

McWhirter et al's No. 1 Vanderneck, NE NW Sec. 3-7-19w (O.W.D.D.)	Drlg. 2,035 ft.
Shell Pet. Corp. et al's No. 1 Faulkner, C SE NW Sec. 11-15-4w	Rig.

NOBLE COUNTY

Shell Pet. Corp. 's No. 1 Farr, C NE NE, Sec. 19-20-2w	Spud.
Sinclair Prairie's No. 1 Jerome, SW cor. Sec. 15-20-2w	Fishing 4,149 ft.
Rollins et al's No. 1 Frank, SE SW Sec. 6-20-2w	Rig.

OKFUSKEE COUNTY

Natl. Investers' No. 1 Billy, SE NW NW Sec. 29-12-9	Drlg. 1,000 ft.

PAWNEE COUNTY

G. N. Mainess and Westfield Drlg. Co.'s No. 1 Schilcberg, NW SW NW Sec. 27-22-6	S.D. 1,100 ft.
Deep Rock's No. 1 Crow, NE SE Sec. 26-23-5	Abd. 3,100 ft.

PAYNE COUNTY

Kemp & Nunnelee's No. 1 Crane, SW SE SW Sec. 10-17-6	Rig.

PONTOTOC COUNTY

Hughes et al's No. 1 Norris, CNL NE SE Sec. 28-4-7	Drlg. 440 ft.
Gilbert's No. 1 Starritt, NW SE Sec. 28-4-5	Rig.
Choctaw O. & G. Co.'s No. 1 Thompson, SW NE SW Sec. 1-1-7	Machine.
Blackwell O. & G. Co.'s No. 1 Abbott, NW SW NE Sec. 14-4-6	Sand 1,542-90 ft.; T.D. 1,710 ft.; to P.B. to 1,190 ft; C.O.

POTTAWATOMIE COUNTY

Payne Drlg. Co.'s No. 1 Lovelace, NW SW NW Sec. 27-6-4	S.D. 1,500 ft. for wtr.

SEMINOLE COUNTY

English et al's No. 1 Harjo, NE SW Sec. 3-8-8	Fishing 676 ft.
Carter Oil Co.'s No. 1 Keokuk, C N½ NW NE Sec. 2-10-6	Flowed 2,327 bbls. in 23 hrs. 4,090-4,160 ft.
Donnelly et al's No. 1 Shepard, SE NE Sec. 4-8-8	Sand 1,395-1,405 ft; wtr.; fishing 1,640 ft.
Harris-Hays' No. 1 Harjo, NE SE NW Sec. 11-6-6	C.O. 2,805 ft.
Stanolind-Amerada's No. 1 Palmer, NW Sec. 36-6-7	Simpson 3,909-72 ft; 882 bbls.

Southern Oklahoma

ATOKA COUNTY

L. E. Stewart et al's No. 1 Stewart, SE SE Sec. 2-4s-10	Drlg. 1,400 ft.

CARTER COUNTY

E. M. Boring's No. 1 Morgan, C NE NW SW Sec. 4-1s-3w	Showing 12,000,000 ft. gas 2,038 ft; C.O.

JEFFERSON COUNTY

Abbott et al's No. 1 Simmons, NW cor. Sec. 14-8s-6	Drlg. 310 ft.
Bridwell Oil Co.'s No. 2 Front, NW cor. Sec. 3-7s-6w	Drlg. 1,990 ft.

MARSHALL COUNTY

Lee Cross' No. 1 Hamlin, SE SW SW Sec. 26-6s-5	Abd. 970 ft.

TILLMAN COUNTY

Emenheser et al's No. 1 Pace, C SW Sec. 3-4s-17w	Drlg. 2,662 ft.
Gypsy Oil Co.'s No. 1 Pitcher, NW Sec. 26-4s-15w	Drlg. 1,320 ft.

where gas production was found several years ago.

E. M. Boring and others' No. 1 Riddle, NE NW SW, Section 4-1s-3w, northwest of the Tatums Pool in Carter County, has been shut down while the owners prepare to land and cement 1,500 feet of 8-inch casing. The well blew in making what was estimated to be 10,000,000 feet of gas at 2,039 feet and flowing considerable water from a shallow sand at 1,000 feet, which was not cased off.

The Carter Oil Co.'s No. 3 Spraggins, SW cor. NW SW, Section 19-1s-2w, on the east side of the Tatums Pool, is estimated at 15,000,000 feet of gas and 200 bbls. of oil per day from a series of sand at 2,060-2,195 feet.

G. L. Pace's No. 2 Mitchell, SW cor. NW NW, Section 30-1s-2w, was cleaning out before taking a potential test. The well is estimated to be 150 bbls. a day from sand series at 2,034-2,180 feet, while the total depth of the well is 2,620 feet.

Another well will be drilled in the Marlow area, Grady County, Heenan & Coe's No. 1, NE cor. NW NW, Section 32-2-7w, being a location. It is located near the failure of the English Drilling Co.'s well which found showing of oil at 3,266 feet and was drilled to a total depth of 3,505 feet, and is now shut down.

Revival in Pontotoc and Coal

The completion of a large gas well in the southern part of Pontotoc County has resulted in a demand for leases in that area with the result that the Muskogee agency of the Five Civilized Tribes put up for sale a number of tracts in the vicinity.

The discovery well was W. A. Delaney and others' No. 1 Hardin, NE cor. SW Section 30-2-7, a wildcat well, completed for 30,000,000 feet of gas a day from the Gilcrease sand at 1,170-85 feet. The second well to find gas in that area is the same operators' No. 1 Richards, NE cor. SE Section 30-2-7, estimated 30,000,000 feet of gas from 1,281-1,306 feet and showing oil. It is the direct east offset to the discovery well.

The tracts offered by the agency are in Townships 2-7, 2-6 and 1-6, all in Pontotoc County, 37 tracts, comprising 3,934 acres.

In Coal County the agency offered a number of tracts around the townsites of Clarita, Stonewall and Tupelo. A total of 27 tracts comprising 1,963 acres were for sale. All of the Coal County acreage is located in Townships 2-8 and 1-8.

Interest in Coal County is expected to be in the vicinity of Dodd & Burton's wells. In November, 1930, these operators drilled a test in the SW cor. SE NE Section 35-1-8 to the Wilcox sand at 4,770-93 feet, where it found water, was plugged back to 1,800-1,900 feet and completed for a 10-bbl. well. The same operators drilled another well in the NE cor. SE Section 35-1-8, and completed it for 1,000,0000 feet of gas a day at 1,760-1,846 feet.

Another Lawsuit

A temporary restraining order was granted in the district court by Judge Babcock on a petition of Governor Murray, asking that the Ambelle Oil & Gas Co.'s No. 1 Richolson, in the SE of Section 22-11-3w, in the Oklahoma City Pool be shut down, alleging that the well was overproducing.

A hearing on a permanent injunction is expected to be held some time this week. Many express the opinion that this suit may prove a test of the whole of the proration situation in the State.

It is alleged in the petition that the Ambelle Oil & Gas Co.'s well is overproducing and is maintaining a public nuisance and endangering the property rights of thousands of royalty owners. It is also stated that the company has refused to furnish daily reports, and that such other reports as were furnished were false. The case was filed by J. L. Ballard, assistant attorney general.

The State claims that as it owns a section of school land in the Oklahoma City Field, with approximately 32 producing wells on it, it has a proprietary right as well as governmental interest in proration.

Plug Back to Gas Sand

In Oklahoma City Field eight former oil wells have been plugged back during the week by order of the Oklahoma Corporation Commission and reclassified as gas wells. Sinclair Prairie Oil Co.'s No. 3 Stamper, in Section 30-11-3w, was plugged back from 6,555 feet to 6,120 feet; same company's No. 6 Stamper, in Section 30-11-3w, from 6,656 feet to 4,860 feet. Cromwell-Franklin Oil Co. and others have plugged back six of their wells, Nos. 4, 11, 12, 16, 29 and 32 on the Trosper Park lease. All of these wells but Nos. 29 and 32 were completed in the Siliceous lime and the others were originally completed in the Simpson sand and all have been plugged back to the Pure sand.

Atoka County

Croxton and others' No. 6 Miller, SW cor. NE NE Section 9-1-14, made 5 bbls. from 140-70 feet.

Creek County

A. A. Bailey's No. 2 Lewis, NE cor. NW SW Section 18-19-9, is a rig. Duke & Hughes' No. 2 Evans, CEL SE NE Section 30-19-9, is a rig. Elliott Brothers' No. 1 Nave, SE cor. SW Section 1-18-8, is a rig. L. B. Jackson's No. 1 Hall, NW cor. SW NE Section 26-18-8, is a rig. Same operators' No. 3 Willis, SW cor. SE NW Section 26-18-8, made 1,000 bbls. from 1,325-58 feet. Same operators' No. 4 Willis, SE cor. SW NW Section 26-18-8, made 800 bbls. from 1,298-1,330 feet. J. E. Crosbie, Inc.'s No. 2 Escoe, NW cor. NE SW Section 26-18-8, made 1,300 bbls. from 1,312-47 feet. Same operators' No. 3 Escoe, C NE NW SW Section 26-18-8, made 800 bbls. from 1,291-1,327 feet. Gray and others' No. 1 Ruffin, SE cor. NE Section 2-18-8, was dry and abandoned at 2,655 feet. Michling's No. 5 Daniel, C W half SE NE Section 32-17-11, made 750,000 feet of gas from 615-30 feet. Sinclair Prairie Oil Co.'s No. 2 Hicks, NW cor. SE Section 6-15-7, old well drilling deeper, made 12,000,000 feet of gas from 3,644-59 feet, total depth 4,023 feet.

Hughes County

Murrah and Bahaman's No. 2 Jacobs, NE cor. SE NE Section 16-7-8, is a rig. Mid-Continent Petroleum Corp.'s No. 2 Jacobs, SW cor. NE SE Section 9-7-8, made 290 bbls. in 13 hours from 2,882-2,928 feet. Phillips Petroleum Co.'s No. 2 Jacobs, SE cor. NE NE Section 16-7-8, made 221 bbls. in 22 hours from 2,860-2,980 feet.

Kay County

Continental Oil Co.'s No. 1 Dickerson, NE cor. SE Section 27-29-1, old well drilling deeper, made 39 bbls. from 3,383-92 feet.

Lincoln County

Elm Oil Co.'s No. 1 Wolf, NW cor. NE NW Section 12-15-6, made 346 bbls. from 3,634-97 feet.

Logan County

Shell Petroleum Corp.'s No. 1 Faulkner, C SE NW Section 11-15-4w, is a location.

Marshall County

Kingston Oil & Gas Co.'s No. 2 Adams, SE cor. SW SW SE Section 31-7s-6, made 15 bbls. from 552-60 feet. Lee Cross' No. 1 Hamlin, SE cor. SW SW Section 26-6s-5, was abandoned at 970 feet.

Oklahoma County

Blackwell Oil & Gas Co.'s No. 1 School Land, SW cor. SE Section 26-12-3w, is a location.

Okmulgee County

English & Henderson's No. 1 Jefferson, SE cor. SW NW Section 36-15-14, was drilling at 1,275 feet. W. B. Pine's No. 1 Adams, NE cor. NW Section 6-14-12, was drilling at 500 feet. A. G. Hazlett's No. 1 Dunbar, NW cor. Section 31-14-13, was completed for 20 bbls. from 1,945-65 feet. Denton & Marshall's No. 14 Colbert, NE cor. SW NW Section 14-14-14, made 35 bbls. from 1,748-79 feet.

Osage County

Lewis Production Co.'s No. 1, SW cor. NW Section 27-24-7, is a rig. Bay Oil Co.'s No. 1, SE cor. SW Section 25-24-7, is a location. The Texas Company's No. 1, NW cor. SW Section 11-26-6, made 93 bbls. from 2,828-81 feet. Silurian Oil Co. and others' No. 59, SW cor. NW NE NW Section 18-23-12, made 5 bbls. from 1,690-1,704 feet.

Payne County

Amerada Petroleum Corp. and others' No. 1 Thompson, NE cor. SW Section 15-18-3, is a rig. Amerada Petroleum Corp.'s No. 1 Gorby, NE cor. SW Section 28-18-4, was abandoned at 4,130 feet. Pure Oil Co.'s No. 2 Kennedy, SE cor. NE NW Section 9-18-5, old well drilling deeper, made 197 bbls. from 3,515-20 feet.

Pawnee County

Deep Rock Oil Corp.'s No. 1 Crow, NE cor. SE Section 26-23-5, was abandoned at 3,100 feet.

Pottawatomie County

Wellman's No. 1 Weldfeldt, SE cor. NE NE Section 3-7-4, made 88 bbls. from 3,677-3,834 feet.

Pontotoc County

I. T. I. O.'s No. 2 Taylor, NW cor. SE SE Section 28-5-5, made 90 bbls. in three hours from 2,153-2,319 feet.

Seminole County

Harvey Drilling Co.'s No. 1 Chapman, NE cor. SE Section 8-6-8, is a rig. Carter Oil Co. and others' No. 1 Community Canard, C S half SW SE Section 36-11-6, is a rig.

Stephens County

Anderson and Kerr's No. 1 Payne, SE cor. SW Section 18-1-5w, is a location.

Believe Roosevelt Can Aid Petroleum Industry

(Continued from Page 35)

hold their prices regardless of developments in other markets. Cleaners' naphtha was advanced from a range of 5 to 5¼ cents to a range of 5¼ to 5½ cents; rubber solvent was advanced from a range of 5 to 5¼ cents to a range of 5¼ to 5½ cents, and petroleum spirits was advanced from a range of 3¾ to 4 cents to a range of 3⅞ to 4 cents.

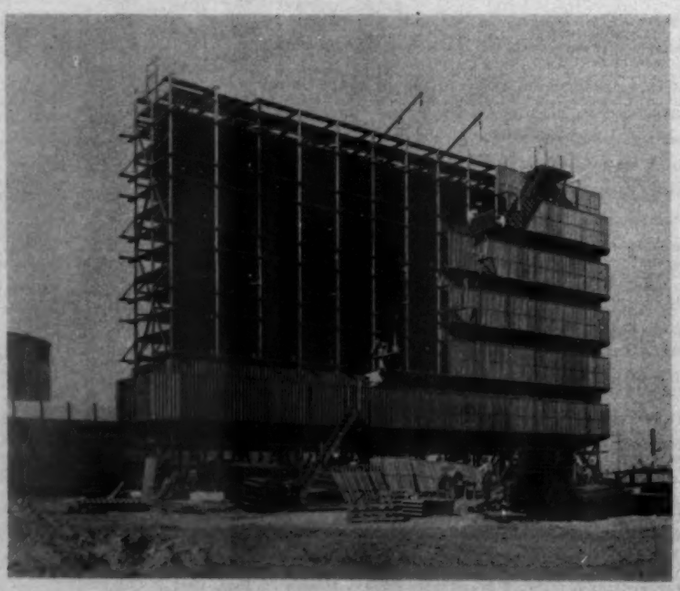
Kerosene Tank Car Markets

The kerosene tank car markets, in spite of increasing price cuts off the tank wagon throughout a large part of the territory, are holding up considerably better than the trend in the light distillates would indicate. Prices are unchanged from last week on representative movement of materials, although several refiners have advanced their prices slightly.

Distillates and Fuel Oils

While the weather has been unfavorable from the motor fuel standpoint, the cold has not been severe enough nor of sufficient duration to cause an appreciable bulge in demand. It is reported that the distillates and gas oils are being run to cracking units, but there is apparently enough material available to fill all current needs. Prices on practically all of the heating materials have moved down as follows: 32-36 zero straw distillate, off an eighth of a cent to 1⅞ to 2⅛ cents; 38-40 straw and 38-40 prime white, unchanged; 32-36 industrial gas oil, down an eighth of a cent to 1 to 1⅛ cents; 28-30 zero fuel oil, down 5 cents a barrel to 70 to 75 cents; 26-28 zero fuel oil, down 2½ cents to 60 to 65 cents; 22-26 zero fuel oil, down 2½ cents to 47½ to 52½ cents; 18-22 zero fuel oil, unchanged; below 18 fuel oil, down 2½ cents to 37½ to 40 cents. Petroleum coke prices continue unchanged and probably subject to developments in anthracite prices and coal freight rate revisions.

Something New in Cooling Tower Equipment



Redwood aerators being superimposed on the existing structure at a California refinery to prevent wind blown spray without impairing cooling performance. Installation by Fluor Corporation

JOHN STOKES DIES

CHATHAM, Ontario, Mar. 27.—Word has been received in Petrolia of the death at San Francisco of John Stokes, aged 59. Deceased was a son of the late Samuel Stokes, oil producer and builder of underground storage tanks in the early days of the Petrolia Field. As a young man he learned the driller's trade, at 22 making his first trip with a party under A. F. Townsend to Borneo for a British syndicate. He later drilled in California, Venezuela and Trinidad, and for six years has lived retired at Los Angeles.

BOLIVIANS SEEK OIL

The Compania Petrolera Sud Americana, organized in 1931 by Bolivian landowners, which controls possible oil lands in the Chaco, has sent a representative to Chile and France to raise money.

Production in Kansas Continues Steady Course Upward, With Promise of Greater Demand

By W. A. SPINNEY
Staff Correspondent, Kansas Fields

Oil production in Kansas continues its steady increase and many express the opinion that the daily average in the State is nearing its maximum. For the week ending March 25, production was estimated at 122,800 bbls. per day, an increase of approximately 7,000 bbls. daily over the previous week. Another increase is expected next week owing to a greater demand in the Hollow-Church Field in Harvey County, where nominations were increased from 350 to 500 bbls. per well, on March 24. Oil production was further extended north in the Hollow-Church Field, indicating that the production in that field and the Mabee Pool may join. New potentials were ordered by the newly formed Corporation Commission in the Ritz-Canton-Decker and Voshell Fields in McPherson County and the Stratman and Stoltenberg Fields in Ellsworth County.

Important Pool Extension

The Hollow Pool, in Harvey County, was given a further extension to the north during the week when The Texas Company and McComb's No. 1 Dyck, SW cor. NE SW, Section 8-22-3w, found oil in the chat at 3,170-3,201 feet. The well is estimated to be good for 1,000 bbls. of oil and 10,000,000 feet of gas per day. It is shut down until tankage is erected on the lease. The well is three-quarters of a mile north of the Carter Oil Co. and Frank Hollow's No. 1 Schmidt, in Section 17-22-3w, a recent completion, which also extended production a mile north of the Hollow Pool.

Assess Stripper Wells

As the result of the meeting between oil producers and county officers in Neosho, Allen, Wilson and Montgomery Counties a flat rate of $165 each was assessed against stripper oil wells and $90 for gas wells in those counties. The new rates are from 15 to 20 per cent lower than they were last year in Neosho County. Oil production was valued at $66 per year, and equipment at $99; gas wells at $62.50 per well per year and gas equipment at $27.50. Producers at the conference said the average production of the stripper wells in the counties is one-third of a barrel of oil per day. The production of the gas wells was estimated at 1,250,000 feet of gas per day per well. The prevailing price for the gas is 5 cents per 1,000 feet and for the oil 30 cents per barrel.

New Potentials

Potential tests have been ordered on all wells in the chat and the deep horizons in the Ritz-Canton-Decker Field for a period of 48 hours to start on April 1 at 7 a.m. These tests are to be taken under the direction of the state oil umpire, L. R. Pickrell, and according to rules and regulations promulgated by the commission now in effect.

The potential tests in the Voshell Pool, in McPherson County, are to start on all wells on April 5 at 7 a.m., ending April 7 at 7 a.m.

The commission ordered 24-hour potentials on all wells in the Stratman area in Ellsworth County, these tests to be taken on April 10 at 7 a.m. The commission found that inequities in the taking of crude oil from this common source of supply now exist and that new tests should be taken in order that a fair and ratable taking may be continued.

Potential tests will be taken in the Stoltenberg Field in Ellsworth County, starting on April 8 for 24 hours on all wells, on account of inequities that now exist.

The Corporation Commission also ordered that the application of F. H. Hollow and others to separate the new producing well in Section 17-20-2w, Harvey County, from the other production in the Hollow Pool be denied. The commission said it found that the well is part of what is known as the Hollow-Church area and is producing from the same common source of supply as the wells in the Hollow area. It is to be prorated and produced on the same basis as wells in the Hollow Field.

The application of Lloyd, Frost, Study and others to separate the Mississippi lime production in the Hollow Field was also denied after it had been given due consideration. All wells producing from the Mississippi lime will be prorated and produced on the same basis as other wells in the Hollow Field.

D. Shawver and others' No. 1 Nichols, NE cor. NW NW Section 28-17-1w, a wildcat in the eastern part of McPherson County, found the top of the chat at 2,642 feet with water at 2,720 feet and it was drilling deeper at 2,850 feet. The chat was logged about 100 feet higher in this test than in other wells drilled in the vicinity.

Vickers Petroleum Co.'s No. 1 Kerr, NW cor. SE Section 15-16-12w, a wildcat test in the northern part of Barton County, found water in the Kansas City lime from 3,102-90 feet and was drilling deeper.

Important New Wells

Further development of the 27,000-acre block of Slick, Pryor & Lockhart and others in northwestern Rice County and southwestern Ellsworth County was indicated when the same operators' No. 1 Orth, SE cor. NE, Section 27-18-10w, made 360 bbls. of oil in 20 hours from Siliceous lime at 3,236-43 feet.

The well is 6½ miles south of the same operators' No. 1 Heiken, discovery well in Section 27-17-10w, located on the same block. The development of this large area has been delayed on account of the lack of a pipe line outlet, but now the oil is moving to the Sunflower Refining Corp.'s plant at Hutchinson.

The discovery well was drilled about three years ago and since that time two offset wells have been completed.

Stanolind Oil & Gas Co.'s No. 1, NE cor., Section 12-23-12w, in the Richardson Pool, in Stafford County, swabbed 1,190 bbls. of oil in 24 hours from Siliceous lime at 3,532-70 feet. Aylward and Shell Petroleum Corp.'s No. 1 Bryant, SE cor. SW SW, Section 11-26-2, in Sedgwick County, swabbed 670 bbls. of oil and 171 bbls. of water from chat at 2,850-75 feet. Shell Petroleum Corp.'s No. 6 Lygrisse, SE cor. NE NE, Section 15-26-2, in Sedgwick County, swabbed 395 bbls. of oil from Viola lime at 3,155-59 feet.

On the Chase Townsite

The third well to be drilled on the Chase Townsite in Rice County is Douglas and others' No. 1 on Lot 50 in Section 31-19-9w. This well is being drilled near the Roy Ramsey discovery well on the Chase Townsite, which is estimated to be a 300-bbl. producer from the Siliceous lime.

T. Deal and others have made a location for No. 1, SW cor., Section 26-33-1, Sumner County.

Roy Ramsey and others' No. 1 Smith, NW cor. SW, Section 32-19-9w, on the Chase Townsite of Rice County, was drilling at 2,350 feet. This is the second well to be drilled on the Chase Townsite.

McPherson County Very Active

New locations in central Kansas include the following: D. Shawver and others' No. 1 Lilly, in Section 28-17-1w; Carlson, Bailey and others' No. 1 Carlson, SE cor., Section 4-19-3w; Sherman, Reynolds and Hatch's No. 1 Krehbiel, NW cor. SE, Section 27-21-3w; W. E. Schultz and others' No. 1 Kuns, NW cor. NE SE, Section 12-19-3w; Frank Whan and others' No. 1 Nelson, NW cor. SE, Section 18-19-2w; Aldrich and others' No. 1 Stromquist, SW cor. SE SE, Section 2-19-3w; L. Prunty and others' No. 1 Jones, SE cor. SW NW, Section 26-19-3w; Gaume & Maxwell's No. 1 Strohn, C NE NE, Section 36-19-3w; W. E. Reeves and others' No. 1 Swanson, SW cor. NE, Section 13-19-3w; Clum and others' No. 1 Nelson, C SE NW, Section 12-18-4w; Spitz and others' No. 1 Blair, NW cor. SW SE, Section 29-19-1w; Sever and Hessman's No. 1 Schrag, SW cor. SE, Section 22-19-4w; Investors Mineral Development Co.'s No. 1 Kaufman, SE cor., Section 35-21-3w; Gaume and Maxwell's No. 1 Goering, SE cor. NE SW, Section 24-21-3w; Darby Petroleum Co.'s No. 1 Bruckner, NE cor., Section 24-19-1w; Lario Oil & Gas Co.'s No. 1 Wilke, C SE NE, Section 34-20-4w, all in McPherson County, and McComb and The Texas Company's No. 1 Dyck, SW cor. NE SW, Section 8-22-3w, Harvey County. On some of these locations slush pits have been dug, while some others have advanced to the status of rigs or even to moving in material.

Greenwood County Development

In Greenwood County, Theta Oil Co.'s No. 1, SE cor. SW NE, Section 22-22-12, in the Norton Pool, between Madison and Lamont, found oil in the Bartlesville sand from 1,688-1,714 feet. It is estimated at 25 bbls. a day and was cleaning out after a shot of 60 quarts. Empire Oil & Refining Co.'s No. 3 Duby, NE cor. NW SW, Section 14-22-11, in the Madison district, is an old well that was drilled deeper and then plugged back and shot. It increased its production after a shot. The old total depth was 1,905 feet and it was drilled to 1,955 feet and plugged back to 1,951 feet and shot with 140 quarts from 1,914-45 feet, where it made 42 bbls. of oil and 7 bbls. of water in 16 hours.

Mendenhall and others' No. 3 Johnson, NW cor. NE NE, Section 8-25-13, in the Quincy district, Greenwood County, was abandoned after it found a showing of about 2 bbls. of oil which was deemed insufficient for commercial production. The showing was found at 1,485-95 feet. The Mississippi lime was found at 1,460 feet and the total depth of the well was 1,600 feet. It was plugged back to 1,500 feet and shot from 1,485-92 feet.

In Other Counties

The Derby Oil Co.'s No. 1 Schmidt, SW cor. NW, Section 17-22-3w, in the north extension area to the Hollow Pool, in Harvey County, found the top of the chat at 3,161 feet and the 8-inch casing was landed and cemented at 3,163 feet. It is the west offset to Frank Hollow and others' extension well in the area.

J. McMorrow and E. B. Shawver and others have taken over No. 1 Kelly, SW cor. NW, Section 22-20-10w, a wildcat northwest of Raymond in Rice County, which was drilled to 2,595 feet about two years ago and shut down since. The present operators plan to drill the test to the Siliceous lime. The well is located on the east edge of the Schurr Pool, in Rice County.

Butler County

Cosmic Oil Co.'s No. 53 Porter, C E half NW NE Section 1-26-4, made 55 bbls. from 2,405-18 feet.

Ellsworth County

Smith and Ash's No. 1 Shango, SW cor. Section 24-17-10w, made 193 bbls. in 18 hours from 3,239-70 feet.

Cowley County

Deal Oil & Gas Co.'s No. 2 St. John College, SW cor. NW NW NE Section 27-32-4, made 48 bbls. from 2,346-69

(Continued on Page 111)

Wildcat Operations in Kansas

(Descriptions are East unless marked otherwise)

BARTON COUNTY

Company, farm and location—	Remarks:
Noble Drlg. Co.'s No. 1 Grant, SW SW Sec. 4-20-11w	Drlg. 3,294 ft.
Vickers Pet. Co.'s No. 1 Kerr, NW SE Sec. 15-16-12w	Drlg. 3,190 ft.

ELLSWORTH COUNTY

Rex Etnyre's No. 1 Arnsman, C SW SW Sec. 10-15-7w	Rig.

GRAHAM COUNTY

Schleimeyer et al's No. 1 Smith, SE Sec. 24-8-25w	Drlg. 4,094 ft.

GREENWOOD COUNTY

Reeser & Chriswell's No. 1 Buyer, C SW SW Sec. 28-26-16	Spudding and S.D.
Wright's No. 1 Madren, SW SE SW Sec. 29-22-12	Machine.
Knight et al's No. 1 Moser, NE SW SW Sec. 33-22-12	Machine.

HARVEY COUNTY

Phillips Pet. Co.'s No. 1 Weebe, NE SE NE Sec. 30-23-2	Drlg. 3,539 ft; top Siliceous 3,528 ft.

MARION COUNTY

Farrell et al's No. 1 Williamson, C NW SE Sec. 21-19-4	Drlg. 2,835 ft.

McPHERSON COUNTY

Darby Pet. Co.'s No. 1 Bruckey, NE NW NE Sec. 24-19-1w	Rig.
Gaume & Maxwell's No. 1 Goering, NE SW SW Sec. 24-23-3w	Rig.
Investers Mineral Dev. Co.'s No. 1 Kaufman, SE Sec. 35-21-3w	Rig.
Lario O. & G. Co.'s No. 1 Wilke, C SE NE Sec. 34-20-4w	Drlg. 3,515 ft.
Shawver et al's No. 1 Nichols, NE NW NW Sec. 28-17-1w	Drlg. 2,834 ft.

PRATT COUNTY

Ninnescah O. & G. Co.'s No. 1 Hardesty, SW SE SE Sec. 28-27-11w	Drlg. 3,802 ft; S.O. 3,657-58 ft.

RICE COUNTY

Langston et al's No. 1 Wells, NE SE Sec. 4-20-9w	Drlg. 150 ft.

ROOKS COUNTY

Kruger's No. 1 Rathburn, SE NW SW Sec. 14-9-16w	Rig.

SALINE COUNTY

Dieter, Warren and Lario O. & G. Co.'s No. 1 Fulton, SW NW Sec. 14-16-2w	Drlg. 1,965 ft.

STAFFORD COUNTY

Atlantic Oil Prod. Co.'s No. 1 Gates, NW SE Sec. 27-21-13w	Drlg. 2,225 ft.

SUMNER COUNTY

Deal O. & G. Co.'s No. 1 Tompkins, SW cor. Sec. 26-33-1.	Drlg. 310 ft.

Wildcats in Sabine and De Soto Parishes Center of Interest in La.-Ark.-Mississippi Area

By D. H. BANCROFT
Staff Correspondent, Louisiana-Arkansas

SHREVEPORT, La., Mar. 27.—The Sandfield Oil & Gas Co.'s No. 1 Bowman-Hicks, Section 26-9-13, Converse area of Sabine Parish, Louisiana, and Mrs. A. L. Ibach's No. 1 Rambin, Section 32-11-11, DeSoto Parish, 6 miles northeast, were still the most interesting wildcats in this territory at the end of the week, both having made promising gas shows the week before only to develop salt water after blowing a short while. Magnolia Petroleum Co.'s No. 1 Olivet, Section 4-16-26, Miller County, Arkansas, making 45 bbls. naturally, from 2,925 feet is that still highly problematical area's fourth producing well. It is an east offset to the Baker and McMurray producers, the only offset that has been successful.

Otherwise, there were only two other completions, a 100-bbl. flowing well in Zwolle, A. H. Tarver's No. 1 Barthold & Steinhorst, SW SW Section 25-8-12, at 2,452 feet, and a dry hole in Natchitoches Parish, Texana Oil Co.'s No. 1 Clark-Morse Lumber Co., Section 23-5-6, at 3,475 feet.

Ten new locations were divided three in Caddo, four in Zwolle proven territory, one in Red River and one in Webster Parish. Tom Collins Petroleum Co. made location and has derrick up on the Gill & Lipscomb land in Section 17-16-16, in the Bethany area of Caddo Parish-Panola County, Texas, gas field, for a 3,500-foot test on a block of 1,700 acres. Pyramid Oil & Gas Co. has derrick up for No. 1 Shuttleworth, SW NE Section 3-18-16, Blanchard gas area of Caddo. United Gas Public Service Co. staked location for No. 1 Lake Holt, SW cor. fractional Section 32-23-16, on the Louisiana-Texas line in the Rodessa deep gas area. W. W. Smith is moving in rig to drill No. 1 T. J. Wilkinson, SW NW Section 3-12-10, Red River Parish, proven territory. The four Zwolle locations are C. H. Tuttle's No. 4 Byrd, NW NW Section 7-7-10, a derrick; C. H. Lyon's No. 1 Stille, NE SE Section 16-7-11, rigging up; Loring Oil Co.'s No. 20 Bowman-Hicks, NW NW Section 15-7-12, and Ohio Oil Co.'s (Mid-Kansas) No. 1 A. C. Phillips, SW SW Section 30-8-11. The Webster Parish location is W. O. Blackman's No. 1 Pardee Co., SW NW Section 36-22-10, a mile south of the Gleason wells drilled in 1920-21 that led to the discovery of Haynesville and Cotton Valley Pools. The Gleason wells were the cause of a great commotion among the operators in this territory although both were lost as craters.

Mississippi and the border counties of East Texas reported nothing of immediate interest.

NORTH LOUISIANA

A. W. Phillips sidetracted bailer lost in No. 1 Oden, Section 4-18-13, Bossier Parish, 6 miles north of Shreveport, and was arranging to set packer for a test at 1,907 feet. Caddo Prairie Oil & Gas Co. used acid without success on No. 1 Hawkins, Section 14-22-15, Hosston district of Caddo, at 1,826 feet, in the chalk, and is waiting orders. The Texas Company's No. 20 D. H. Raines, Section 15-21-10 in the same district, is waiting for standard rig to pump after a shot of acid at 1,700 feet.

Andrew Currie of Shreveport has blocked the north half of Township 14, Range 16, comprising the extreme southwest corner of Caddo Parish and amounting to approximately 7,000 acres for a 3,500-foot test to be begun by April 15, probably in Section 7-14-16, which location would be about 6 miles south of Panola County, Texas, gas. O'Brien Brothers, also of Shreveport, have a block of 24,000 acres in the northwestern part of Allen Parish, and have derrick up for No. 1 Long-Bell Lumber Co., NW SW Section 34-4s-6w, 10 miles west of Oberlin. It is scheduled to go 6,000 feet and will be one of the important tests on the Conroe-Jackson trend that has been having such a lease play for the last several months.

Other Operations

United Gas Public Service Co.'s No. 1 Meadows, Section 13-21-5, Claiborne Parish, 10 miles north of the Trinity gas of the Sugar Creek Field, tested 50 joints of salt water and 12 joints of mud in 20 minutes from 4,390 feet and was drilling at 4,500 feet. Bailey Gants' No. 1 Jenkins, SE SW Section 35-13-12, DeSoto Parish, Naborton district, had a gas show at 870-90 feet in the Nacatoch and is waiting for a string of casing, total depth 975 feet. Mrs. Ibach's No. 1 Rambin, NE NE Section 32-11-11, showed some oil at 3,054 feet in broken sand and shale but swabbed dry. The well is a rank wildcat in the southeastern part of the parish near the Sabine Parish line. Warren and Craig's No. 1 J. A. Wagner, Section 5-12-14, 8 miles west of Mansfield, tested salt water at 2,830 feet in sand and shale and was coring at 2,880 feet in what was supposed to be the top of the lower Woodbine.

Graham Production Co.'s No. 1 Lites, SE SW Section 28-8-11, Zwolle proven territory, was dry at 2,600 feet and is waiting orders, probably for a shot of acid. Nowlin and Cherry's No. 1 Turner, NW NW Section 4-7-11, was in the same fix but had a show of oil at 2,444 feet. Pelican Natural Gas Co.'s No. 20 Louisiana Long Leaf Lumber, SE NE Section 8-7-11, bailing to test at 2,716 feet was rather deep for Zwolle production but surface elevation will account for part of the excessive footage. Pugh-Hickman Drilling Co.'s No. 3 Blackman, NW NW Section 36-8-12, an offset to their big producer of two or three weeks ago, was a distinct disappointment, bailing dry at 2,407 feet, but is drilling deeper.

In the Converse area of Sabine Parish Lambert and others' No. 1 Edwards, SW NW Section 29-9-13, 3 miles west of the Sandfield well, bailed a little oil from 1,971 feet and was arranging to go on down. H. C. Lessenger's No. 1 Bowman-Hicks, NW SW Section 13-9-13, topped the marl at 1,585 feet and is shut down for orders at 1,594 feet. Sandfield Oil & Gas Co.'s No. 1 Bowman-Hicks, NE NE Section 26-9-13 killed the gas blowout at 3,404 feet by the use of four tons of baroid added to the mud and is waiting for a string of 6-inch to be set at 3,230 feet to shut off the water from the Blossom at around 2,330 feet. R. T. Henderson's No. 1 Sistrunk, a wildcat in Section 9-9-12, a wildcat southeast of Pleasant Hill, was swabbing a little oil after an acid test at 2,079 feet.

Pipe Line Runs

Due to both the Baker and McMurray wells in the Miller County, Arkansas, Field being on the pump, plus Magnolia Petroleum Co.'s No. 1 Olivet's 45 bbls. Miller County production went back to the 300 bbls. per day it registered for a short while two months ago. But as a whole, daily average runs from the several pools in this district shrank 940 bbls. The runs from the several pools were:

NORTH LOUISIANA

	Bbls.
Caddo light	5,055
Caddo heavy	1,745
Cotton Valley	615
DeSoto-Red River	1,770
Elm Grove	345
Haynesville	3,940
Holly	210
Homer	2,720
Pleasant Hill	295
Sarepta-Carterville	700
Urania	2,500
Zwolle	11,300
Total	31,195
Last week	32,290
Decrease	1,095

ARKANSAS

Champagnolle	1,445
El Dorado	2,640
Lisbon	405
Miller County	300
Nevada County	850
Smackover light	2,590
Smackover heavy	21,875
Stephens	140
Urbana	580
Total	30,825
Last week	30,670
Increase	155
Both states	62,020
Last week	62,960
Decrease	940

Wildcat Operations in Louisiana-Arkansas

(Rotary operations unless otherwise designated)

North Louisiana

BOSSIER PARISH

Company, well, farm name, section and block—	Remarks:
John L. Anderson, tr.'s No. 1 Leonard, 600 ft. E, 300 ft. N, SW cor. Sec. 19-19-13	Drlg. 700 ft.
Cryer Oil Co.'s No. 1 fee, 2,400 ft. N, 1,650 ft. E, SW cor. Sec. 25-19-12	Cmtd. 6-in. 852 ft; drlg. plug.
A. W. Phillips, tr.'s No. 1 Oden, 300 ft. W, 150 ft. N, SE cor. NW NW Sec. 4-18-13	Set 6-in. with packer 1,360 ft.; sidetracked and arranging to set 6-in. with packer 1,607 ft.

CLAIBORNE PARISH

United Gas Public Service Co.'s No. 1 Meadows, approximately 100 ft. S. center E½ E½ Sec. 13-21-5	D.S. test 4,470 ft; drlg. 4,529 ft.
United Gas Public Service Co.'s No. 1 Temple, 1,340 ft. W, 660 ft. N, SE cor. Sec. 21-23-7	Drlg. 3,412 ft.

DE SOTO PARISH

Bailey Gantz et al's No. 1 Jenkins, NW cor. SE SW Sec. 35-13-12	S.D. for csg.; gas show 870 ft.; T.D. 890 ft.
Mrs. A. L. Ibach, tr.'s No. 1 Rambin, 250 ft. S and E. NW cor. NE NE Sec. 32-11-11	Arranging to deepen; 3,054 ft.
State Drlg. & Prod. Co.'s No. 1 Wempie, 330 ft. N and E, SW cor. NW SW Sec. 14-13-11	S.D. shale 2,300 ft.
Warren & Craig's No. 1 J. A. Wagner, 150 ft. S and W from C, Sec. 5-12-14	Coring 2,880 ft.

NATCHITOCHES PARISH

H. H. Temples' (was Natchitoches Pet. Co.'s) No. 1 Edenborn, 2,240 ft. W, 1,320 ft. S, NE cor. Sec. 4-11-6w	S.D.; W.O. 3,156 ft.

OUACHITA PARISH

Southern Carbon Co.'s No. 15 Fairbanks, 1,920 ft. N, 660 ft. W, SE cor. Sec. 5-19-4	S.D.; W.O. 1,065 ft.

RAPIDES PARISH

Evers & Collingsworth's (was A. G. Beck et al's) No. 1 Hickman-Simmons Lbr. Co., 330 ft. S, 330 ft E, NW cor. Sec. 40-4-1e	Drlg. 900 ft.

RED RIVER PARISH

Edward & Clay's No. 1 Delta Pecan Co., 1,600 ft. N, 450 ft. E, SW cor. Sec. 37-13-11	Drlg. 2,205 ft.

SABINE PARISH

R. T. Henderson's No. 1 Sistrunk, 450 ft. N, 150 ft. W, C, Sec. 9-9-12	Bailed dry; W.O. 2,079 ft.
C. D. Loe, tr.'s No. 1 Whitney, 330 ft. N and W, SE cor. NW NE Sec. 19-9-14	Base chalk 2,197 ft; S.D.; W.O. 2,205 ft.
J. G. Puterbaugh's No. 1 Pickering Lbr. Co., SW cor. SW SE Sec. 13-4-12	Coring 1,460 ft.

CONVERSE DISTRICT

Cloud & Bolin's No. 1 Bowman-Hicks, SE cor. NE NE Sec. 26-9-13	Gas blowout 3,404 ft; arranging 6-in. 3,230 ft; T.D. 3,404 ft.
Lambert et al's No. 1 Edwards, 300 ft. S and E, NW cor. SW NW Sec. 29-9-13	Arranging deepen; T.D. 1,971 ft.
H. C. Lessenger's No. 1 Bowman-Hicks, 330 ft. S, 330 ft. E, NW cor. Sec. 13-9-13	S.D. W.O. 1,585 ft.
Joe Modisette's No. 1 Frost Lbr. Industries, 330 ft. S and W, NE cor. Sec. 20-9-13	Cmtd. 8-in. 1,538 ft; bailing.
Zwolle Prod. Co.'s (was Baird Bros.') No. 1 Tatum, SW NE Sec. 25-8-12	S.D. 2,331 ft; (C.D.); waiting on rig.

TENSAS PARISH

H. V. Schumacker's No. 1 Currey, 1,320 ft. S, 1,320 ft. E, NW cor. Sec. 39-11-12	S.D. 3,725 ft.

UNION PARISH

Paul G. Benedum's No. 1 J. M. Sterling, 330 ft. N and W, SE cor. NE SW Sec. 29-21-2w	Tested S.W. 2,540 ft.

(Continued on Page 115)

Federal Control of Oil Urged by E. T. Moore

DALLAS, Tex., Mar. 25.—Edward T. Moore, president of the Mid-Continent Oil and Gas Association, Texas division, urges Federal control of the oil industry. He said he believed the step would have to be taken "if we are to have relief from the present disorganized estate of the oil industry. Some of the major companies, no doubt, would oppose such a step."

Mr. Moore expressed belief that the next week would "tell the tale" as to the fate of proration with the changes "about 50-50" that efforts to control production would be abandoned.

Although opposed to government ownership of the oil industry, he said the Government should control it under some proration or other plan "that would conserve our oil for defense and our national needs."

Another Coastal Dome at Cameron Meadows; Southward Extension to the Conroe Field

By NEIL WILLIAMS
Staff Correspondent, Gulf Coast Fields

HOUSTON, Tex., Mar. 27.—Drilling into salt at Cameron Meadows, southern Cameron Parish, Louisiana; proving of important southward extensions at Conroe, and starting up of additional wildcat and semiwildcat operations in the exploration play now on in the district featured Gulf Coast Field developments the past week. Leasing and blocking continued active in several areas, namely Tom Ball-Huffsmith of Harris County, and southern and central Polk County, and took on renewed interest generally throughout the Gulf Coast, particularly in southern Louisiana.

Salt at Cameron Meadows was found in Magnolia Petroleum Co.'s No. 3 Cameron Meadows, the third well drilled on this geophysical prospect, and was topped at 6,179 feet. The hole late in the week was coring deeper in the salt at a total depth of 6,347 feet. This definitely proves another coastal dome to add to the steadily swelling list, which now is up in the eighties.

Although this is the first salt encountered, the dome already is on production. Magnolia's No. 2 Cameron Meadows, 500 feet due north of the present test, was completed in October, 1931, as a 1,000-bbl. well in a sand at 5,270 feet and still is producing although since the original completion it has been worked over and deepened 3 feet. The first test drilled, No. 1 Cameron Meadows, which is 500 feet due north of No. 2, made a small gasser in a sand at 3,850 feet and has produced a little fluid, being completed in January, 1930. It also was drilled to the 5,270-foot sand and proved the existence of oil production but due to bad hole was forced to go back to the shallower sand for completion as a small gasser. Both these wells, drilled by the former Vacuum Oil Co., which discovered the prospect and leased it in its entirety, encountered numerous sands and gave every indication of a deeply seated dome field.

The third and present test has been started since Magnolia Petroleum Co. inherited the field in the merger of the two companies. It also found the numerous sands and in the sand at 5,273 feet was brought in as a well but sanded up after flowing three days and then was deepened.

The area, located in the marsh lands just a few miles inland from the Gulf of Mexico, was worked with the seismograph in 1928, and, some torsion balance work is reported having been done. There are numerous seeps in the district and it generally has been taken for granted that a dome existed there. Production is moved by barge to Magnolia's Beaumont refinery.

Conroe Extension

Production of Conroe was extended nearly a mile southward by the bringing in of Malta Oil Co.'s No. 1 Texas Osage, in the southeast corner of the G. Harris Survey. This well, generally carried as Alpha Oil Co.'s No. 1 Falvey, is cleaning itself as this is written and there is no production gauge but it is estimated to be flowing between 15 and 20 bbls. A working pressure of 55 pounds on the tubing through a seven-sixteenths-inch choke, is shown.

Bottom of the hole is 5,180 feet and was supposedly substantially below the water level of the sand. The well is reported to have run approximately 240 feet low and encountered the Hockleyensis marker at 4,217 feet. Surface elevation is 153 feet. The sand is that one commonly referred to as the "Keystone Mills" sand, which is the sand in a horizon overlying the main "Conroe" sand and which over the main field carries only high pressure gas. This is the ninth well which has been completed in the sand, which is productive of oil southward and eastward down the flanks and whose oil productive area is estimated at a little over 1,200 acres extending a distance of 3½ miles around the edge of the main field.

Proration of wells in this sand was lifted the past week on the contention of certain operators at a recent railroad commission hearing that the sand constituted a new and entirely separate field. Under the state laws, a new field is permitted to reach a daily production of 10,000 bbls. before production restrictions can be imposed except for the prevention of actual physical waste. Until now wells in this sand have been under the same restrictions as those placed upon the Conroe Field proper.

Wells now producing from the "Keystone Mills" sand are: Plummer & McDaniels' (Gulf Coast Drilling & Producing Co.) No. 1 Keystone Mills, the discovery well; South Gulf Oil Corp.'s No. 1 Granger, Sun Oil Co.'s No. 1 Stewart, Tide Water Oil Co.'s No. 1 Granger, Mortex Oil Co.'s No. 1 South Texas Development Co., Alpha Oil Co.'s No. 1-C South Texas Development Co., Feltex Oil Co.'s No. 1 Bertrand, Bishop Oil Co.'s No. 1 Smith & Ratcliffe, and Malta Oil Co.'s No. 1 Texas Osage.

On the extreme northeast edge of the field, Hamilton, Hill & Hill have succeeded in making a producer in their No. 2 Gilbert, John Davis Survey, and initial production was estimated between 25 and 30 bbls. through a one-half inch choke from sand at a total depth of 5,149 feet. This well marks a slight extension and at its present depth has 16 feet to play on above the water level. This test originally drilled into the water.

Conroe Completions

Conroe completions totaled 22 during the week, the majority of which were on inside locations. Daily production now has mounted to approximately 40,000 bbls. despite another readjustment of proration schedules cutting the allowable of 20-acre units to 126 bbls. daily. The drilling curtailment program recently initiated by Humble Oil & Refining Co. is being reflected in the field's operations with a decline being noted in the number of rigs actually operating.

Sugarland Extension

Koimm Production Co. apparently has a small extension southward for the Sugarland Field in its No. 1 Peterson. The well has not been completed and estimates of its production cannot be made but it is starting to flow and probably will make a small well. It set 78 feet of screen in sand at 3,756 feet. This is the only well to be drilled at Sugarland outside of unit development of the field by Humble Oil & Refining Co.

Tom Ball-Huffsmith

Although there is no production in the Tom Ball-Huffsmith area of northern Harris and southern Montgomery County, the State Railroad Commission has called a hearing for next week with a view to regulating spacing of drilling operations. The area has undergone, and still is in the midst of, an intense leasing play and is due for an active drilling development. Much of the acreage, particularly around the Tom Ball Townsite, which is in the middle of the play, is divided into small tracts, so spacing restrictions are being sought now to forestall any difficulties which might arise in the event production is opened. Permits already have been issued for tests on three small sites in the townsite.

Magnolia Petroleum Co. is building derrick for its second location on its Tom Ball block. This will be No. 1 Kobs, 923 feet west of the east line and 1,650 feet south of the north line of the (lower) J. M. Hooper Survey, Abstract 372, which is approximately 3 miles to the southwest of the company's No. 1 Martens in the Joseph House Survey which now is rigged up and ready to start drilling.

Galveston County

The San Leon prospect, Galveston County, on the west side of Galveston Bay, has been figuring in an active leasing program with Humble Oil & Refining Co. the principal purchaser. This company has just paid $10 an acre for a 12 months' lease on 900 acres in the San Leon Farm Home tracts from the J. S. Cullinan interests, and on the south side of the bayou has bought 1,700 acres of the Oleander Heights Subdivision, paying $17,000 cash and agreeing to drill a 5,500-foot test.

San Leon was "hot" several years ago when a geophysical survey in the district indicated the existence of a possible salt dome. At that time Humble Oil & Refining Co. started to lease but its play was broken into and the company backed off. Since then the area has been permitted to rest although occasional attempts at leasing have been made.

Calcasieu Parish

Shell Petroleum Corp.'s No. 3 Heyd, Calcasieu Parish, Louisiana, a half mile south of production of the Iowa Field, has encountered a sand showing oil at a total depth of 5,539 feet and has run 9⅝-inch casing to test. Production in the field is from a 6,900-foot sand although the shallower sand has been found. The latter generally has been cased off because of possible blowouts.

Liberty County

Yount Lee Oil Co. has made location and is building derrick for its second test on the Plummer prospect on the Liberty-Chambers County line. This test, No. 1 E. W. Boyt, is on the Liberty County side, 300 feet north of the south line and 2,440 feet west of the east line of Section 17, H.&T.C. Survey, which is slightly less than a mile to the north of the company's first test, No. 1 Plummer, Section 28, H.&T.C. Survey, northern Chambers County. The latter, the deepest wildcat ever drilled on the Gulf Coast, was abandoned last January at 9,334 feet.

Location has been made by Gulf Production Co. for a 1,600-foot eastward extension test at Hankamer, southern Liberty County, this to be on the Crowe & Jacobs tract in Section 21, H.&T.C. Survey. There has been no development at Hankamer, a field owned entirely by the Gulf Production Co., for several months.

Polk County

Another important wildcat will be that to be drilled by Boone, Clark & Boone on land of the Texas Long Leaf Timber Co. in the D. B. McComb Survey, southeast of Leggett, central Polk County. This is on a 2,900-acre block adjoining a block obtained recently by Mid-Kansas Oil & Gas Co. and which has created considerable interest. A drilling contract requires the Boone wildcat to spud by March 31.

Wharton County

Smith and associates' No. 1 Mitchell, H. & T.C. Survey No. 8, Wharton County, and located on Shell Petroleum Corp.'s Lake View prospect, has twisted off 6,320 feet of drill pipe in the hole with bottom at 6,875 feet. This wildcat has been much watched in view of important showings which have been encountered indicating the existence of another new field there.

Gulf Coast Fields and Wildcats

Week Ending March 25

Company, farm and location—	Remarks
RACCOON BEND—AUSTIN COUNTY	
Humble O. & R. Co.'s No. 5 Diemar, 713 ft. from NE line, 2,000 ft. from NW line of Wm. Harvey Sur.	Drlg. sand 2,408 ft.
DAMON MOUND—BRAZORIA COUNTY	
Intercoastal Oil Co.'s No. 10 Wisdom, A. Darst Sur., 440 ft. from NW line, 170 ft. from SW line of tract.	Heaving shale 3,978 ft; plugged to 3,705 ft; set 50 ft. of 2¼-in. screen; comp. pumping 200 bbls. daily.
MANVEL—BRAZORIA COUNTY	
The Texas Co.'s No. 1 Davis, 250 ft. S 42 deg. W and 400 ft. N 48 deg. W out of E cor. of Lot 31, H. N. Little Sur.	Drlg. gumbo 583 ft.
The Texas Co.'s No. 1 Natali, 300 ft. S 42 deg. W and 200 ft. N 48 deg. W out of E cor. of Lot 43, Div. E, Suburban Gardens Subd., H. N. Little Sur.	Drlg. sand, shale and boulders 3,391 ft.
BARBERS HILL—CHAMBERS COUNTY	
Humble O. & R. Co.'s No. 2 Kirby, Henry Griffith League, 100 ft. W of E line of lease and 300 ft. N of No. 1	Drlg. salt 2,845 ft.
Mills Bennett Prod. Co.'s No. 2-C Gulf fee, Wm. Bloodgood Sur., 175 ft. N of No. 1	Sandy shale 4,380 ft; D.S. stuck.
Sinclair Prairie Oil Co.'s No. 14 Wilburn, Henry Griffith League, 150 ft. W of No. 12	T.D. 4,075 ft; sidetracking in hard sandy lime 3,138 ft.
Sun Oil Co.'s No. 16 Wilburn, Henry Griffith League, 150 ft. W of No. 14 and 50 ft. N of S line	Drlg. rock 1,098 ft.
The Texas Co.'s No. 3 Lawrence fee, Henry Griffith League, 740 ft. W of E line in center of tract.	T.D. in salt 5,278 ft; milling out to sidetrack 3,623-28 ft.
The Texas Co.'s No. 9 Wilburn, Henry Griffith League, 680 ft. E of NW cor. and 50 ft. S of N line	Salt 2,035 ft; cmtd. cavity; drlg. out cmt.
Texas Gulf Prod. Co.'s No. 1 O. K. Winfree (W.O.), W. D. Smith Sur., 50 ft. from S line, 100 ft. from W line of tract	T.D. 5,512 ft; pulling tubing to deepen.

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Magnolia's Wildcat in Jim Wells County, Texas, Looks Good; Bastrop County More Active

By B. D. STEVENSON
Staff Correspondent, Southwest Texas Fields

SAN ANTONIO, Tex., Mar. 27.—It looks now as though the Magnolia Petroleum Co. might get a pretty good well in its wildcat, No. 2 Seeligson in southern Jim Wells County. Last week it was thought it would at least be a small pumper and hold the leases. Later it was deepened a couple of feet to a total of 3,253 feet and swabbed some more and late the past week was blowing a good big volume of gas and a little water and spraying around 6 bbls. of oil an hour. Some estimated it at as high as 10 bbls. an hour which would make it a pretty fair well. It is thought that the water is due to a poor cement job and the well was to be killed and recemented and completed again some time this week.

The test had 3 feet of hard sand at 3,244-47 feet and set casing at 3,247 feet. It was bailed to the bottom through the tubing when the hole was bottomed at 3,251 feet, and later bailed to the bottom with the tubing out but finally began to improve in appearance and conduct and late in the week before being killed it had the appearance of opening something new in the way of a pool.

This well is located 3,000 feet from the east line and 150 feet from the south line of J. T. Canales Survey No. 218 and is about 4 miles northwest of Premont. It is about 9,000 feet south and a little west of the company's No. 1 Seeligson, drilled last year to a little below 6,000 feet and finally abandoned though it had some thin sands and slight showings of oil and gas.

The new well is about on a line between the Kingsville Field, 20 miles to the east in Nueces County, and the East Cole Field in Duval County, 30 miles to the west. The nearest production is the two wells in northwestern Brooks County about 18 miles southwest of it. It is therefore a pure isolated wildcat and furthermore, with the exception of the No. 1 Seeligson, there seems to have been no wildcat tests drilled anywhere within several miles. The famous million-acre King ranch comes up to within a short distance of the east side of the Seeligson ranch and on the southwest is a block of 9,000 acres in one ranch the owners of which have stoutly refused to consider an oil lease of any kind. In northern Brooks and southern Duval Counties, several miles west, a number of major companies several years ago took some big blocks but never did any drilling and other than this the territory has been given no attention on the part of the oil industry.

Stewart Gets Showing

William B. Stewart's No. 1 Duval County Ranch Co., in northern Duval County, which blew in late last week while attempting a drill stem test, was successfully killed and is trying now to get to the bottom with casing. It did not blow wild very long. Total depth is 2,297 feet and is 1 foot in sand and the core is thought by many to look extra good.

The location is approximately one-half mile west and 1½ miles north of production at the north end of the North Government Wells Pool, which takes a northeast-southwest trend and is about 8,000 feet nearly due northwest of the Humble Oil & Refining Co.'s No. 3 Hahl in Survey 360, which is the farthest north test in the field. Contour lines and geology as worked out as the basis for drilling the Stewart test seems to indicate that if he succeeds in getting production he will open another pool, the south end of which will lay just a little west of the north end of the North Government Wells Pool and extend northeast.

Stewart's No. 1 is in Survey 362 and 990 feet from the south and east lines of the northeast quarter of the survey and the No. 2 has set casing on the Cole sand at 1,566 feet after testing about 10,000,000 feet of dry gas and it is located 330 feet from the north line and 990 feet from the east line of the south half of the southwest quarter of the same survey, approximately 3,750 feet due southwest of the No. 1. No. 2 should be ready to drill in this week and from the drill stem test would seem almost sure to make a good gas well. No. 1 at latest reports was still trying to get casing in the hole so as to test.

The Sun Oil Co.'s No. 1 Duval County Ranch Co. in Survey No. 78, located 2,500 feet east and 1,000 feet north of Stewart's No. 1, is coming back for attention and study. It was completed last year and made a small pumper in sand at 2,137-67 feet. It drilled to a total of 2,676 feet and plugged back to the sand at 2,137-67 feet. It is lower down on the structure and yet has sand a little higher than in the Stewart test.

Shasta Oil Co.'s No. 1-B Peters set casing at 2,690 feet, top of the sand 2,682 feet and total depth 2,707 feet, the footage being corrected since last report. Late in the week it had drilled plugs and was preparing to bring the well in. This test is about 1,320 feet east of the No. 1 Peters that made a big gas well at 2,431-51 feet and No. 1-B missed that sand but has picked up the Mirando sand at 2,682 to 2,707 feet.

The other spots being watched in North Duval County are the Smith & Hunter block 7 miles east of the North Government Wells Pool and No. 1 Olivarez which is still standing at 2,622 feet. It is understood that No. 1 Pena, in Survey No. 79, the discovery well, and about 1,500 feet northwest of the No. 1 Olivarez, has gone dead. It was producing considerable gas at 1,910 feet.

Very little progress has been made on other wildcats in North Duval and southern McMullen Counties. The Jacqua & Crow's No. 1 Hagist in southern McMullen is standing at 2,232 feet. The next new wildcat in that part of the country to get attention will be the two prospective tests, one in Survey No. 792 and the other in Survey No. 796, to be drilled by G. G. Mortimer and Dr. M. P. Springer of Tulsa, on the Peale ranch, a little west of the Shasta tests.

Bastrop Activity

Three wells good initially for around 50 bbls. an hour drilled by the Humble Oil & Refining Co. in the new Hilbig Pool in Serpentine in southern Bastrop County have been responsible for a lot of new activity and Bastrop County is to be worked all over again by big and little companies in search for Serpentine production. Humble is building some storage and has not yet extended its pipe line to the field but has two rigs that will be kept in the field for a time.

Efforts the past two years or more when a few operators were constantly at work in the county have not been so fruitful of results but the Humble's find accentuates the interest. Eastland Oil Co. is offsetting on the west the discovery well of Ogden & Reed on the Riddle farm, near the south line of the county and several miles south of the Humble's field, and Marts & Beavens are about to make a well of their No. 1 Riddle, a little west of Ogden & Reed, and Ogden & Reed are starting another test on the Riddle. New activity in the county is reflected in a considerable increase in the number of land men and geologists in the county who are looking around to see if anything has been overlooked.

Deep Test in Webb County

Edwin M. Jones, who drilled the 9,131-foot test at Refugio, the deepest hole in the Gulf Coast, is moving in a big rig from East Texas and is going to drill a deep test in Webb County. It may go as deep or deeper than the test at Refugio and will be by far the deepest test in the Laredo district if it reaches any such depth. Humble drilled one test in the Kohler Field to 7,725 feet, where it was abandoned without making a producer.

Edwin M. Jones' test is to be in Section 603 of the B.S.&F. Survey, about 20 miles due west of the new Moca Pool and about 13 miles east of the town of Callihan on the Missouri Pacific Railroad. It is about the same distance east from the town of Cactus and slightly south.

One of the biggest structures in the Laredo territory is in evidence there and its presence has been known to the fraternity for some time but never drilled and the new wildcat will be in a territory all by itself.

Bastrop County Wildcats

C. L. Witherspoon is to drill a test on the A. D. Harris tract in Bastrop County in the Maxmillan Survey and C. C. Shumway is to drill a test on the J. W. Buckner tract, 1½ miles west of the town of Red Rock.

In the Balcones Fault zone area the Teas & Gant's No. 1 Mikulec, in southeastern Bastrop County, to be an Edwards lime test or go to 7,000 feet, was down 6,700 feet late in the week and still in chalk and it may fail to reach the Edwards inside of 7,000 feet. The other Edwards lime test that has been in attention for some time is the Patron Brothers' No. 1 Turner in northern Lee County. It shot off the drill stem and is now trying to sidetrack.

At the west end of the Balcones Fault the Zavala Oil & Gas Co.'s No. 1 Gates, in Zavala County, is expected to start making hole again this week. It has been standing for some time at a little below 3,000 feet and was carried for a time as the Adair & Daniels' No. 1 Gates.

Starr County

The B.&B. Oil Co.'s No. 1 Kelsey Bass, a little southeast of Rio Grande City, is understood to have arranged for casing which will be on the ground this week or early next week. It stood at 4,520-26 feet with a showing of gas, while being reamed down. Since then another 4-foot core was taken and there is a chance that it will make a well of some kind. Many of the other tests in the county are shut down.

Saxet Field

In the Saxet Field in Nueces County there are three tests in the 4,800-foot sand that are looking promising. Houston Oil Co.'s No. 3 McGregor, a west offset to the Violet Oil Co.'s dry hole in that sand, got the sand at 4,848-64 feet and set casing after testing 19 fourbles of oil. It looks like a sure shot for a producer. Gulf Port's No. 1 Rand Morgan, 2 miles away and a south offset to the Gibson Oil Co.'s No. 1 Rand Morgan, has set casing at 4,858 feet and looks like a well, and Holliday's No. 1 Smith at 4,874 feet has drilled plugs and is a well, but no gauge has been reported.

Laurel Field

It looks like Wise & Jackson's No. 1 Garcia & Villareal in Survey 1,100, at the south end of the Laurel Field in Webb County, would make a pretty good oil well of around 400 bbls. daily at 2,204 feet, extending the field about a quarter of a mile south from the Dyck Oil Co.'s No. 3 Garcia & Villareal that came in for 100 bbls. an hour. Several new locations have been made in that territory among them the Montex in Survey 720 considerably to the east and Sal-Mar Oil Co. that has had a location a mile or more northeast of the field has rigged up and is starting to work.

In the Tuleta Field, Astec Oil Co. abandoned at 4,109 feet its No. 1 Taylor at the southeast end of the field, but is

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Wildcat Operations in Southwest Texas

Week Ending March 25

Company, farm and location—	Remarks:
ATASCOSA COUNTY	
Jacob, Bussini & Pickett's No. 1 Schroeder, 160 ft. from N and W lines of 159-ac. tract in Frederick Anthony Sur.	T.D. 200 ft.; drlg.
BASTROP COUNTY	
Champion's No. 1 Rivers, center W½ of 800-ac. tract in Osborne Sur.	T.D. 1,610 ft.; drlg.
J. E. Emanuel's No. 1 H. Klemm, 317 ft. from W line, 300 ft. from S line of tract in R. S. Toal Sur.	T.D 263 ft.; resumed drlg.
Marts and Beavens' No. 1 Reyes, 750 ft. from W line, 150 ft. from S line of 48-ac. tract in Addison Lytton League	Spudded in.
Teas and Gant's No. 1 Mikulec, 330 ft. to NW and SW lines of tract in Wm. Barton Sur.	T.D. 6,700 ft.; drlg. chalk.
BEE COUNTY	
Humble Oil & Refining Co.'s No. 1 Imogene Hall, 1,815 ft. from SW line, 330 ft. from SE line of tract in Thomas J. Butler Sur.	Location; moving in.
BEXAR COUNTY	
R. S. Boling's No. 1 J. J. Appelt, 150 ft. from N and W lines of tract in M. Uriegas Sur.	T.D. 320 ft; drlg.
E. R. Byrd's No. 1 W. H. Russell, 750 varas from NE line, 54 varas from NW line of Fernandes Rodrigues Sur.	T.D. 1,100 ft.; S.D. in chalk.
Motes-Campbell's No. 1 Pruitt, 650 ft. NE of Trussell's No. 1 Pruitt, 54 varas from E line of tract in Samuel McCollough Sur.	T.D. 1,000 ft; drlg.
Ethridge et al's No. 1 Dilharts, 150 ft. to N and E lines of SE 100 acres of Dilharts 340-ac. tract in F. Rolen Sur.	Moving in.

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Full Operations Are Resumed in California Fields Following Failure to Agree on Suspension

By L. P. STOCKMAN
Staff Correspondent, California Fields

LOS ANGELES, Calif., Mar. 25.—Operations were resumed late this week by all California companies following a partial shutdown of a week's duration resulting from the earthquake of March 10, and a check made this morning shows practically all companies in full operation. The Union Oil Co. opened up 25 per cent of its restricted production at 5 p.m. March 21 and a like amount on each of the succeeding three days, with the result that the company was back on a normal operating basis early this morning. The Standard resumed production at Whittier, Santa Fe Springs and Inglewood March 23; West Coyote, Richfield and Fullerton March 24 and went on a full time basis in all remaining fields today. The Associated resumed production activities in all fields March 23 and reached normal operations at 7 a.m. gauge this morning. Coincident with the resumption of production activities, major companies resumed the purchase of production on the basis of allocations prevailing previous to the temporary suspension of operations.

Efforts to effect a 15-day shutdown in all California fields to improve the statistical position of the industry by reducing stocks of crude and refined oils, and thus make available sufficient empty space in storage facilities to permit normal operations, were unsuccessful. The committee of five appointed by the meeting of oil operators at office of the Oil Producers Sales Agency to determine the attitude of the industry relative to a possible voluntary 15-day shutdown rendered its report early this week. The report states that "the committee finds a large number of operators, including several of the purchasing companies, in favor of the proposed shutdown, but also finds a large number opposed thereto. The movement to be successful must be substantially unanimous and the committee's work has progressed sufficiently to make it clear that a substantially large number of operators will not agree to a shutdown. The committee wishes to make it clear that the reasons set forth by those against the proposal have been advanced in good faith and are logically set forth in a spirit of cordial discussion. The committee also wishes to make it plain that the operators proposing the shutdown did so in the sincere belief that a temporary shutdown would accomplish lasting benefit for the industry as a whole." The committee, consisting of H. A. Bardeen, W. C. Whaley, Joseph Gilliland, W. H. Geis and T. H. Sherman, after investigating conditions disbanded without prejudice to such further efforts by the operators in general as they may desire to take. Three of the committee were unalterably opposed to a shutdown, one member was neutral and the other decidedly favorable to the proposed action.

Production Reduced

Despite the lack of unanimity among independent operators, all major companies suspended production activities immediately subsequent to the earthquake of March 10. This action was deemed necessary to permit the reconditioning of damaged facilities and at the same time eliminate fire hazard and expedite the restoration of co-ordinated action between the several branches of the industry. Simultaneous with the restriction in production, major companies temporarily suspended independent operators but began running oil again when production activities were resumed. Cutting off pipe line outlets forced a few operators to restrict production when lease tanks began to fill up, but on the whole, independent operators continued producing and disposed of current production to brokers and independent refiners. Although the shutdown effected by major companies was limited to southern California fields, state production was drastically reduced. The low point was reached March 20, when production of the entire State was recorded as 359,075 bbls. Every field in Los Angeles Basin, with the exception of Potrero, was substantially under the established maximum quota during this 24-hour period. Fullerton was 3,900 bbls. below its established maximum, Dominguez 17,225 bbls. under its quota, Huntington Beach 10,417 bbls., Inglewood 10,501 bbls., Long Beach 8,622 bbls., Montebello 3,170 bbls., Playa del Rey 1,393 bbls., Richfield 3,560 bbls., Rosecrans 2,515 bbls., Santa Fe Springs 13,775 bbls., Seal Beach 7,621 bbls., Torrance 1,545 bbls., Coyote 9,740 bbls. and Whittier 892 bbls. Excesses in the northern part of the State and in the coastal area prevented state production from reflecting the total restriction in the production of Los Angeles Basin. In spite of this condition, however, crude oil production for March 20 was the lowest recorded since June, 1922.

Disturbing Factor

The inability of California operators to agree on the advisability of effecting a 15-day moratorium on production indefinitely delays a restoration of crude oil prices. Those in close touch with the situation were in unanimous agreement that crude prices would undoubtedly have been increased at the expiration of the 15-day moratorium which operators refused to sanction. As the situation stands, there is a possibility of a further weakening in crude and refined oil prices in southern California territory. This possibility exists despite the increase of approximately 5 cents in the price of gasoline in the Pacific Northwest where marketers have been selling below cost during practically the entire year. The restoration of refined prices in the Pacific Northwest, which hit the toboggan late last year following the importation of several cargoes of East Texas gasoline, is nevertheless reassuring. The possible disturbing factor in southern California is the substantial increase in lease stocks of independent operators which accumulated during the period of suspension. If major companies have been able to recondition steel tanks damaged in the earthquake and are in a position to empty these lease tanks, the possibility of a further general weakening in crude and refined prices in Los Angeles Basin will be greatly minimized. A considerable quantity of oil produced during the production moratorium has already been sold but this hot oil sold substantially below existing prices will be absorbed in the normal course of business during the next few weeks. If operators continue to dispose of crude which accumulated during suspension, this action will sooner or later be reflected in the going price, depending upon how cheaply it was sold. Gasoline sales in California during February were approximately 8 per cent in excess of sales during the preceding month, but a little more than 2 per cent below distribution in February last year.

Kettleman Hills

Unless something unforeseen develops, a new drilling record is expected to be established in California during the next few weeks. The possible record breaker is No. 1 Lillis-Welsh of the North Kettleman Oil & Gas Co., an outpost in the extreme western part of the North Dome Field. This well, which is nearing the 10,200-foot level, will be carried to approximately 11,000 feet if mechanical conditions permit, although drilling operations may be concluded above this point if a sufficient thickness of oil sand is encountered. The Western Gulf holds the present drilling record so far as California is concerned, as it reached 10,296 feet in No. 1 Bradley, a wildcat in the Santa Maria district, abandoned last year. If the North Kettleman Oil & Gas Co. reaches 11,000 feet in No. 1 Lillis-Welsh it will exceed the California record by 704 feet and the existing world's record established in Mexico by 477 feet.

Although no completions have been made in the North Dome Field since the first of the month, a check of development work under way indicates the probable completion of several new wells within 30 days. The Union is stepping along with No. 3 Amerada King and since it is already down below the 7,700-foot level it should be finished before the close of April. No. 6 Huffman of the Superior, which is at 7,525 feet, and the Standard's No. 8-21 J at 7,310 feet should follow. The Standard has just spudded in No. 4-29 J, in the North Dome Field, and this project, which offsets the Superior's Huffman and the Union's King lease, will pass the 1,000-foot level within a few days. The Standard is still fishing for drill pipe in No. 6-29 V in the Middle Dome, but has made much progress during the past two weeks. The Petroleum Securities suspended drilling operations on No. 1 Burbank in the Middle Dome Field about a year ago due to the inability to overcome mechanical trouble. A request was recently made by the Petroleum Securities for permission to drill a second hole in the Middle Dome but then Secretary of Interior Wilbur did not take any action on the request as it was received only a few days before the relinquishment of his office to Harold L. Ickes.

Lost Hills-Belridge

Continental Oil Co. has started rig construction for No. 4 Result, in the North Belridge Field of Kern County,, and spud is expected within 10 days. This well is scheduled for completion in the Temblor at approximately 5,500 feet, although it will be finished with pipe sufficiently large to permit deepening to the Wagonwheel zone in the Eocene. The Belridge Oil Co. is starting two new wells, both, Nos. 16 and 49, being in Section 35-27-20. Operators interested in conservation and retarding development work in the North Belridge Field have held a series of informal meetings in an effort to devise ways and means of preventing competitive drilling. Completion of the Ohio Oil Co.'s No. 1 Bloemer automatically calls for drilling of several offsets. If all were started there would be 11 strings in operation as a primary basis and a multiplicity of other wells started if any secondary wells were spudded in. No. 1 Bloemer is flowing at the rate of 704 bbls. per day from 8,525 feet, the oil being exceptionally clean and testing 33.3 degrees. Due to the exceptionally low gas oil ratio of No. 1 Bloemer, only 810,000 feet of gas is being produced daily. In the Lost Hills Field the Associated is making normal footage in No. 1 Williamson, a deep test which the company is drilling in conjunction with the Richfield and other operators holding adjacent acreage.

Mountain View

Another few weeks will probably throw additional light on the potentiality of the Mountain View, or Weed Patch Field of Kern County, as Mohawk Petroleum Co.'s No. 1 Hood has passed the 4,150-foot level and should encounter the upper

TANKER SHIPMENTS FROM LOS ANGELES TO DOMESTIC AND FOREIGN PORTS

	March 11		March 4			
Intercoastal-domestic—	Total this week	Daily average	Total last week	Daily average	This year to date	Same time last year
Crude oil	.....	.....	.....	.....	78,085	.....
Fuel oil	73,750	10,536	.....	.....	307,003	.....
Diesel and gas oil	.....	.....	149,935	21,420	772,162	46,225
Gasoline	116,840	16,691	116,440	16,634	1,346,821	836,225
Kerosene	.....	.....	80,411	11,487	411,076	.....
Foreign exports—						
Crude oil	45,910	6,559	132,956	18,994	1,219,896	1,839,719
Fuel oil	159,089	22,727	117,430	16,776	1,334,350	1,944,402
Diesel and gas oil	25,277	3,611	64,034	9,148	624,374	454,380
Gasoline	.....	.....	217,049	31,009	1,117,825	1,966,217
Kerosene	.....	.....	201,848	28,835	485,674	569,904
Naphtha distillates	.....	.....	.....	.....	.....	41,175
Coastwise-domestic—						
Crude oil	388,513	55,502	417,492	59,642	2,449,197	3,027,424
Fuel oil	148,705	21,244	279,813	39,973	2,336,322	3,074,386
Diesel and gas oil	7,788	1,113	5,749	821	367,788	397,531
Gasoline	16,269	2,324	228,924	32,703	2,216,136	2,662,036
Kerosene	1,396	199	.....	.....	29,159	33,072
Naphtha distillates	.....	.....	.....	.....	27,651	.....

TANKER SHIPMENTS FROM SAN FRANCISCO TO DOMESTIC AND FOREIGN PORTS

Intercoastal-domestic—						
Diesel and gas oil	.....	.....	.....	.....	280,531	.....
Gasoline	80,999	11,571	.....	.....	239,016	68,101
Kerosene	.....	.....	.....	.....	311,855	.....
Lubricants	.....	.....	8,250	1,179	8,250	7,849
Foreign exports—						
Crude oil	.....	.....	.....	.....	320,286	271,458
Fuel oil	51,286	8,747	.....	.....	190,939	442,083
Diesel and gas oil	2,191	313	.....	.....	300,145	250,991
Gasoline	73,354	10,479	113,528	16,218	1,064,941	607,815
Kerosene	13,107	1,872	.....	.....	167,050	185,350
Lubricants	.....	.....	.....	.....	13,072	8,225
Coastwise-domestic—						
Fuel oil	64,310	9,187	134,590	19,227	714,045	464,500
Diesel and gas oil	.....	.....	20,831	2,976	142,550	149,876
Gasoline	.....	.....	179,537	25,647	753,424	684,348
Kerosene	.....	.....	14,464	2,066	36,211	10,557

zone if it exists. Dana Hogan's No. 1 Wharton in Section 32-30-29 is about a week behind No. 1 Hood but will have an advantage of several well logs which should prove extremely useful. In the Edison district, A. T. Jergins is rotating in No. 1 Nissen at 1,118 feet, but it will probably be 30 days before either this well or the Caravel Petroleum Co.'s project is deep enough to prove of unusual interest. The General Petroleum has staked location for a new wildcat in the San Joaquin Valley. The area has considerable merit. Rig construction is expected to get under way for the General Petroleum's new test in this area within 10 days. This will be the first wildcat of a major company in California during the year. General Petroleum's new test will be located on the Lovitt permit in Section 10-30-21, a few miles northwest of the McKittrick Field. This well will be on the Sheep Springs anticline and will be a test of the Temblor formation which should be reached at approximately 4,000 feet. General Petroleum will install heavy equipment, however, in the event that deeper drilling becomes necessary. It is of importance because it is located in an area which has been in the limelight for several weeks due to showings of promise encountered in T. H. Purman's wildcat, Section 22-29-21. Purman cemented a string of pipe in his Gould Hills test at 5,390 feet several weeks ago but no additional footage has been recorded although marked showings of oil and gas were carried in the ditch. General Petroleum has tied up approximately 2,000 acres of potential oil land on the Sheep Springs anticline, although Standard, Union, Ohio, Shell, C. C. M. O., Kendon Petroleum, Wesco Petroleum, George F. Getty and the Honolulu Consolidated also have acreage in the immediate vicinity. General Petroleum's wildcat is approximately 4 miles from T. H. Purman's No. 1, which is expected to be drilled out during the next few weeks.

Mount Poso

Federal Petroleum Co. picked up the top of the Jewett zone in No. 3 Dominion, in the Mount Poso Field of Kern County, and a string of 10¾-inch has been landed and cemented at 1,416 feet. This well looks good for production, although the initial depends upon how much additional formation is taken in. Petroleum Securities failed to pick up the second Glide zone in No. 13 Glide and has plugged the hole back from 1,885 feet to 1,676 feet. The well is being bailed but does not look any too hot, although the outlook may be improved after the hole has been cleaned out. California Western Oil Co. began drilling operations on No. 1 Poso in the Mount Poso Field early in the week and preparations are being made to start two additional holes in this area. Standard Oil Co. has resumed work on No. 1 Mascot, a deep test in the Midway-Sunset Field of Kern County, and is testing for production. This hole, bottomed at 9,762 feet, was plugged back to 8,859 feet and subsequently plugged back to 7,995 feet when a test of the formation between these points was negative. Casing is now being perforated above the 7,995-foot level. Union has not yet spudded in No. 1 Keene in this district but should do so in a few days. Milham Exploration Co. has recompleted No. 41-17 in the Buttonwillow gas field of Kern County after plugging the hole back from 2,648 feet to 2,490 feet because of water. The company will now resume work on No. 9 Kern, a drilling well suspended at 4,946 feet and will endeavor to complete it as a gas well. Cascade Petroleum Co. completed its No. 1 in the Fruitvale Field of Kern County at 3,774 feet. This well, finished with a 4½-inch liner carrying 216 feet of perforated, registered an initial of 405 bbls. of 20.6 gravity oil per day through a twenty-sixty-fourth inch bean. In the Devils Den area, Pyramid Hills Oil Co. is still in brown shale as the bit nears the 3,600-foot level.

Rincon

The only work of importance in the coastal region of Santa Barbara County is in the San Miguelito Field where three potential producers are under way. The deepest is No. 1 Valenzuela of the Honolulu Oil Co. in Section 23-3-24. Continental's second well on the Grubb property is down 1,492 feet with a string of 16¾-inch landed just off bottom. This well is half way between No. 1 Grubb and the Honolulu Consolidated's No. 1 Valenzuela. No. 1 Grubb has produced almost 300,000 bbls. of oil since completion last year and is still flowing 930 bbls. of 30.6 gravity oil and 835,000 feet of gas per day from 7,152 feet. Chanslor-Canfield Midway Oil Co. will probably set surface pipe within a few days as No. 3-A Hobson, like other wells in the field, is being started with a large hole. In the Rincon Field of Santa Barbara County, Indian Petroleum picked up the top of the Miley shale in No. 1 Shudde, a tideland drilling project, at 1,424 feet and the bit is in a brown shale a little below 2,500 feet. Woodrow Oil Co. is still held up with mechanical trouble in No. 1 Lomas at 6,580 feet due to the loss of a drill collar and bit. In the Coal Oil Point area of Santa Barbara County, Bolsa Chica Oil Co. has resumed drilling in a second test on tideland permit No. 191, following the landing of a string of 16-inch casing at 505 feet.

Ventura Avenue

Petroleum Securities has recompleted No. 1 Hartman in the Ventura Avenue Field doing 245 bbls. per day after cleaning out and reconditioning the hole. This well, completed in June, 1930, doing 160 bbls. per day from 7,900 feet after the hole had been plugged back from 8,127 feet, has been idle for several months due to inability to show commercial production. Happy Yowell, who attained recognition several years ago in his daring work in combating oil well fires while with the Shell Oil Co. and who subsequently became affiliated with Pacific Western Oil Co., was in charge of the reconditioning work undertaken on No. 1 Hartman. Yowell took this well over on a production basis and recompleted it doing 245 bbls. per day after cleaning out the hole to bottom, 7,900 feet, and reperforating the pipe for some distance above this point. The Associated is grading location for two new wells to be started in the Ventura Avenue Field and will have six strings in operation when these holes are spudded in. All of the wells now under way in this field by the Associated are on the Lloyd lease. General Petroleum is still in oil sand as the 6,800-foot level was reached in No. 15-A Barnard, which is scheduled for completion in the deep 57 zone below the 8,000-foot level. No. 5 Notten, which has just passed the 5,300-foot level, is also in oil sand but, like No. 15-A Barnard, will be carried deeper. Shell's No. 75 Taylor has been showing up rather well at 5,200 feet but will probably pass up the uppermost part of the Lloyd zone to participate in flush production. Operators in the Ventura Avenue Field have been exceeding their current allowable during the winter to meet the demand for gas in southern California but started to reduce production several weeks ago coincident with the lessened demand for gas. Operators in this field reduce production substantially below the established allowable during the summer to eliminate the waste of gas but open up during the winter when consumption of gas reaches its peak. If all flush fields of the State adhered to this practice marketing companies would feel justified in storing excess production during the winter as they would feel assured of being able to liquidate stocks during the summer when consumption of gasoline reaches its peak. Unfortunately a number of operators have been endeavoring to reach maximum production during the entire 12 months. There are four strings under way in the Santa Barbara Mesa Field and unless something unforeseen develops we may anticipate the completion of two or three wells within a few weeks.

Richfield

Extension work around the edge of the Richfield district of Los Angeles Basin took on a rather doubtful aspect during the past week due to the suspension of drilling operations by the Forward Petroleum Co. in No. 3 Davenport at 3,890 feet, at which point a gray water sand was cored. Coupled with this unfavorable development was the fact that The Texas Company's No. 1 Steiner was in a gray sand at 4,075 feet. Otis Hoyt landed and cemented a string of 8⅝-inch in No. 15, his first project in the Richfield district, at 3,724 feet and an early production test will be made. The Lawndale Field of Los Angeles Basin, which has been relatively inactive for several years, came back into the limelight several days ago when No. 4 Peck, originally drilled by the Oscar Smith interest, started blowing a thin film of 35 gravity oil from the 5,800-foot level. Due to the unexpected showing, a determined effort will be made to recomplete the well as a commercial producer. In the Playa del Rey Field, Union Oil Co. has filed an abandonment notice on No. 1 Townsite, due to exhaustion of the productive formation, and will probably also abandon No. 5 Del Rey as this hole, bottomed in schist at 5,882 feet, failed to show any indication of production from top to bottom. The failure to develop commercial production in No. 5 Del Rey proved somewhat of a surprise as it is within throwing distance of a commercial producer. The hole is relatively straight and the absence of oil sand in the deep Recreation zone is probably due either to a lenticular codition of the production formation or a marked lack of uniformity in the underlying schist. The schist was encountered higher in this hole than the point of contact in other wells which appear to be located further out on the structure.

Montebello

Universal Consolidated, a subsidiary of Richfield Oil Co. is nearing the 3,000-foot level in No. 1 Cruz, a projected deep test in the Montebello Field of Los Angeles Basin, and it will probably be

(Continued on Page 117)

IMPORTANT SOUTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status
Hines Pet., No. 1 Ocean Park, Los Angeles Co.	8- 2-15	7,414	suspended
Taylor Oil Co., No. 1 Culver, Los Angeles Co.	12- 3-15	6,233	suspended
Palm Ridge Oil Co., No. 1 Palms, Los Angeles Co.	2- 2-15	4,512	suspended
Pan Tex Oil Co., No. 1 Lawndale, Los Angeles Co.	26- 3-14	5,745	cemented
Baldwin Oil Co., No. 9 Inglewood, Los Angeles Co.	7- 3-14	5,862	suspended
Kupfer, A. M., No. 1 Inglewood, Los Angeles Co.	17- 2-14	5,100	hr. sh. drilling
Pacific Gulf, No. 1 Athens, Los Angeles Co.	19- 3-13	6,904	gr. sd. drilling
Pacific Oil Inv. Co., No. 1 Wilmington, Los Angeles Co.	28- 4-13	3,717	sd. sh. drilling
Wilmington Oil Co., No. 1 Wilmington, Los Angeles Co.	28- 4-13	3,261	sd. sh. drilling
Jones, W. L., No. 1 Lyndwood, Los Angeles Co.	31- 2-13	4,851	sd. sh. drilling
Community Oil Co., No. 1 Montebello, Los Angeles Co.	34- 1-11	4,903	resume work
Universal Consd., No. 1 Montebello, Los Angeles Co.	5- 2-11	3,902	sd. sh. drilling
Willetts Pet., No. 1 Saugus, Los Angeles Co.	35- 5-16	1,904	cleaning out
Smith, J. A., No. 1 Saugus, Los Angeles Co.	32- 5-17	3,515	suspended
Alpha Oil Co., No. 1 Calabasas, Los Angeles Co.	32- 1-18	764	sd. drilling
Hudson Pet., No. 1 Newhall, Los Angeles Co.	1- 3-16	1,000	sd. sh. drilling
Garliepp, F. J., No. 1 Newhall, Los Angeles Co.	14- 3-16	1,940	sd. sh. drilling
Ball, W. T., No. 1 Newhall, Los Angeles Co.	24- 3-16	3,582	suspended
Big Four Oil Co., No. 1 Newhall, Los Angeles Co.	32- 4-16	2,230	suspended
Marble, Willard, No. 1 Van Nuys, Los Angeles Co.	6- 2-16	3,000	repair rig
Nuoil Co., No. 1 Newport, Orange Co.	25- 6-10	3,901	fishing
Mineral Exploration, No. 1 Capistrano, Orange Co.	8- 8-7	4,302	plug 2,400 ft.
Placentia Dev. Co., No. 1 Placentia, Orange Co.	31- 3-9	rig	rigging up
Spindletop Oil Co., No. 1 Salton Sea, Riverside Co.	25- 7-10	3,590	suspended
Keeley, H. J., No. 1 Corona, Riverside Co.	21- 4-6	697	sd. sh. drilling
Duncan, N. I., No. 1 Sagebrush, Riverside Co.	3- 4-6	1,157	suspended
Great American Pet., No. 1 Chino, San Bernardino Co.	18- 3-8	1,650	hd. sd. drilling
Mason Oil Co., No. 1 Salton Sea, Imperial Co.	1-17-15	280	suspended
Woods, D. H., No. 1 Salton Sea, Imperial Co.	7-11-15	774	suspended

IMPORTANT NORTHERN CALIFORNIA WILDCATS

Company, well and location—	S.T.R.	Depth	Status
Fairview Oil Co., No. 1-A Purisima, Santa Barbara Co.	18- 7-34	1,123	sd. sh. drilling
Duell, O. S., No. 1 Naples, Santa Barbara Co.	7- 4-29	5,132	suspended
Equity Oil Co., No. 1 Coal Point, Santa Barbara Co.	24- 4-29	3,750	suspended
Bolsa Chica, No. 1 Coal Oil Point, Santa Barbara Co.	tideland	4,089	suspended
Bolsa Chica, No. 2 Coal Oil Point, Santa Barbara Co.	tideland	505	cemented
Cuyama Oil Co., No. 1 Cuyama, Santa Barbara Co.	12-10-27	2,387	suspended
Woodrow Pet., No. 1 Rincon, Ventura Co.	4- 3-24	6,600	fishing
Indian Pet., No. 1 Rincon, Ventura Co.	tideland	2,561	br. sh. drilling
Commander Oil Co., No. 1 Fillmore, Ventura Co.	13- 4-19	2,400	suspended
Hancock Oil Co., No. 1 Fillmore, Ventura Co.	13- 4-19	1,232	suspended
Honolulu Consolidated, No. 1 Miguelito, Ventura Co.	23- 3-24	5,272	hd. sh. drilling
Continental, No. 2 Miguelito, Ventura Co.	23- 3-24	1,495	cemented
C. C. M. O., No. 3-A Miguelito, Ventura Co.	23- 3-24	1,012	sd. sh. drilling
Midlands Pet., No. 1 Ojal, Ventura Co.	9- 3-23	5,292	hd. sh. drilling
Macrate, A. N., No. 1 Ojal, Ventura Co.	27- 4-23	2,071	suspended
Wilshire Oil Co., No. 1 Sulphur Mountain, Ventura Co.	26- 4-21	1,862	cleaning out
Mosher, J. W., No. 1 Santa Paula, Ventura Co.	32- 4-21	1,081	br. sh. drilling
Hardison & Temple, No. 1 Timber Canyon, Ventura Co.	22- 4-21	248	suspended
Duell, O. S., No. 1 Timber Canyon, Ventura Co.	31- 4-20	216	suspended
Petro Producing Co., No. 1 Timber Canyon, Ventura Co.	18- 4-20	3,350	will set pipe
Los Posas Pet., No. 1 Los Posas, Ventura Co.	22- 3-20	2,952	sd. sh. drilling
Wilshire Oil Co., No. 1 Hardsdale, Ventura Co.	12- 3-20	1,732	suspended
International Oil Developers, No. 1 Conejo, Ventura Co.	33- 2-20	2,770	hd. sd. drilling
Anderson, C. L., No. 1 Santa Barbara, Ventura Co.	36- 3-18	1,011	sd. sh. drilling
Purman, T. H., No. 1 Gould Hills, Kern Co.	22-29-21	5,399	recemented
Purman, T. H., No. 2 Gould Hills, Kern Co.	27-29-21	329	sd. sh. drilling
General Pet., No. 1 McKittrick, Kern Co.	10-30-21	....	location
General Pet., No. 1 Belridge, Kern Co.	30-28-21	8,260	suspended
Cumberland Oil Co., No. 2 Devils Den, Kern Co.	17-26-18	3,270	suspended
Holloway, A. S., No. 1 Devils Den, Kern Co.	11-25-18	1,848	suspended
Hanna, Tom, No. 1 Devils Den, Kern Co.	25-25-18	3,516	suspended
Pyramid Hills Oil Co., No. 1 Devils Den, Kern Co.	24-25-18	3,460	hd. sd. drilling
Fowler, F., No. 1 Blackwell Corner, Kern Co.	15-26-19	3,170	suspended
Associated, No. 1 Lost Hills, Kern Co.	2-26-20	3,121	sd. sh. drilling
Seminole Oil Co., No. 1 Lost Hills, Kern Co.	29-25-21	rig	suspended
Caravel Pet. Co., No. 1 Edison, Kern Co.	19-30-30	316	sd. sh. drilling
Jergins, A. T., No. 1 Edison, Kern Co.	30-30-30	1,118	sd. sh. drilling
Mohawk Pet., No. 1 Weed Patch, Kern Co.	30-30-29	4,193	sd. sh. drilling
Hogan, Dana, No. 1 Weed Patch, Kern Co.	32-30-29	3,131	sd. sh. drilling
Descanso Oil Co., No. 1 Wheeler Ridge, Kern Co.	31-11-19	2,620	suspended
Kingsburg Expl. Co., No. 1 Kingsburg, Fresno Co.	20-16-23	2,970	suspended
Bergman, Harry, No. 1 Kingsburg, Fresno Co.	13-12-11	2,560	hd. sd. drilling
Graham & Loftus, No. 1 Raisin City, Fresno Co.	20-15-18	3,560	recemented
Emerich Oil Co., No. 1 Mendota, Fresno Co.	35-13-13	mtl.	building rig
Kent & McDonald, No. 1 Carrizo Plains, S. Luis Obispo Co.	3-32-22	3,815	cleaning out
Emerich Oil Co., No. 1 Carrizo Plains, S. Luis Obispo Co.	22-32-22	1,541	suspended
Paso Robles Oil Co., No. 1 Edna, San Luis Obispo Co.	27-27-11	4,191	suspended
Shell, No. 1 San Miguel, San Luis Obispo Co.	4-25-12	5,520	hd. sh. drilling
Pacific Inland, Well No. 1, Monterey Co.	19-23-15	2,441	suspended
Guess, E. B., No. 1 Corcoran, Kings Co.	7-21-21	6,197	suspended
Brown, A. M., No. 1 Cloud, Kings Co.	10-23-19	rig	suspended
Dudley Dome Oil Co., No. 1 Dudley Ridge, Kings Co.	9-23-20	3,012	suspended
Knudsen & Schmidt, No. 1 Reef Ridge, Kings Co.	36-23-17	6,873	testing
Kettleman Ridge Oil Co., No. 1 Avenal, Kings Co.	10-23-16	412	sd. sh. drilling
Magee & Stone, No. 1 Alpaugh, Kings Co.	34-24-22	5,060	suspended
Inland Valley Oil Co., No. 1 Visalia, Tulare Co.	24-17-24	3,092	suspended
Napa Oil Co., No. 1 Griffith, Napa Co.	7- 8-3	3,273	suspended
Oakdale Oil Co., No. 1 Oakdale, Stanislaus Co.	5- 2-10	4,313	suspended
Rushing Oil Co., No. 1 Waterford, Stanislaus Co.	20- 3-12	2,621	sd. sh. drilling
Pacific Northern Oil Co., No. 1 Guinda, Yolo County	23-12-3	3,045	suspended
Buttes Oilfields Co., No. 1 Marysville, Sutter Co.	35-16-1	2,731	gas—shut in
Buttes Oilfields Co., No. 2 Marysville, Sutter Co.	34-16-1	....	grade
Tehama Pet. Co., Well No. 1, Tehama Co.	4-22-15	2,904	gr. sh. drilling
Orland Synd., No. 1 Orland, Tehama Co.	31-23-3	3,748	prod. test.
Marker Drlg. Co., No. 1 Orland, Tehama Co.	21-25-3	3,030	suspended

Michigan Activity Now Centers on Otway Pool; Seven Completions in Central Ohio Field

By GEORGE A. WHITNEY
Staff Correspondent, Central West Fields

MOUNT PLEASANT, Mich., Mar. 27. Drilling activity in Michigan at this time is centered around the Otway Pool, in Porter Township, Midland County. There are 11 wells drilling in that area.

Pure Oil Co. is drilling Nos. 1, 2 and 3, 1,650 feet from the south line and 2,310 feet from the P. O. Mates farm, Section 22. Same company is drilling No. 1, 2,310 feet from the south and east line of the State-Porter farm, NW NW SE Section 15. Stork Oil Co. is drilling No. 1, 330 feet from the north line and 990 feet from the west line of the Jesse B. Richmond farm, SW NW SE Section 22, same township. Sun Oil Co. is drilling No. 1 in the southeast corner of the J. L. Miller estate, SE SE NW Section 16, same township. Gordon Oil Co. is drilling on the Baxter farm, NE NE Section 22. Smith Petroleum Co. is drilling No. 1 on the Burkee farm, NE NE Section 22, same township. Charles W. Teeter is starting three wells on the Joe Otway farm, No. 1, NE NE SW Section 22, Porter Township; No. 2, NE NE SW, same section, and No. 3, SW NE SW, same section. Pure Oil Co. is drilling No. 1, 1,738 feet from the north line and 660 feet from the east line of the Martha Clark heirs farm, N half SE NE Section 2, Jasper Township, same county.

Pure Gets 300-Bbl. Well

The best of the late completions in the Central Michigan Field was Pure Oil Co.'s No. 1-A, 330 feet from the north line and 426 feet from the east line of the Joe Novak farm, NE NE SE Section 7, Greendale Township, Midland County, credited with an initial of 300 bbls. from the Dundee formation. This well is midway between the old East Pool and the new extension, an area now being gradually drilled up. The No. 2-A Novak, between No. 1 Novak and No. 5-C Reem, appears to be assured of success as does No. 2 location on the McCann lease, offsetting.

Columbia Oil & Gas Co.'s No. 1, 1,650 feet from the north line and 165 feet from the east line of the Leona Carnell farm, NE SE SW Section 15, Greendale Township, Midland County, failed to make a commercial producer at 160 feet in the Dundee formation and will be a dry hole unless something shows up in further drilling. This is one of the farthest south tests drilled in Section 15 and seems to be in a region of hard structure. Directly east is a dry hole and the next location is George Hanner's Geneva Oil No. 1, which showed but did not flow and is being treated with acid.

Gordon Oil Co.'s No. 7, 330 feet from the south line and 990 feet from the east line of the N. J. Skinner farm, SW SE NE Section 16, Greendale Township, Midland County, showed both oil and gas in the Dundee but did not flow when drilled in and may be given treatment. There were 300 feet of oil in the hole. Offsetting No. 7 Skinner is William H. Hill's Nos. 1 and 2 on the Gilson-Fales farms, both being drilled. Edward Stewart and others' No. 5, 990 feet from the south line and 330 feet from the west line of the Opperman farm, SW SW Section 12, Greendale Township, was drilled deeper into the Dundee without picking up any further pay, but may be given treatment.

Pure Oil Co.'s test, 990 feet from the south line and 330 feet from the east line of the George Vertengruber farm, E half SE Section 27, Vasser Township, Tuscola County, failed to show either gas or oil in the Berea sand. It is now at 2,000 feet and will be taken down through the Dundee.

L. G. Thompson's test, southwest corner of the William A. Ryal farm, SW SW SW Section 3, Mount Haley Township, Midland County, is reported close to 1,500 feet and was reported as checking favorably on the Marshall formation.

T. K. Buzzard's test, 990 feet from the south and west lines of the Frank A. Trout and others farm, NE SW SW Section 7, Denver Township, Isabella County, is below 3,550 feet. Columbia Oil & Gas Co.'s No. 3, 330 feet from the south line and 990 feet from the west line of the William H. Hill farm, SE SW NE Section 16, Greendale Township, Midland County, is nearing pay sand. Theodore Oil Co.'s test, 990 feet from the north line and 330 feet from the east line of the Adrian Steed farm, NE NE NE Section 8, same township is nearing completion as is Talbot Oil Co.'s No. 3-B, 330 feet from the south line and 990 feet from the west line of the State of Michigan land, SW SE SE Section 11, same township.

James M. Taggart and others are drilling around 1,200 feet in a test 1,070 feet from the south line and 400 feet from the west line of the James H. Barton farm, NW SW SW Section 11, Austin Township, Mecosta County.

Otis Denslow is drilling for gas in the southwest corner of the Herman Cook farm, S half NE Section 2, Broomfield Township, Isabella County. Mellon-Pollock Oil Co. is drilling a test 990 feet from the north line and 330 feet from the east line of the Mrs. David Crowley farm, SE NE NE Section 23, Vernon Township, same county. Mammoth Petroleum Corp. is drilling in the northwest corner of the Marseillers farm, NW NW SE, same section, and John C. Arthur, Inc., is drilling No. 2 on the Clarence Thayer farm, NW NW SW Section 22, same township.

Wittmer Oil Co.'s No. 2, 450 feet from the north line and 1,120 feet from the east line of the Sarah Cashen farm, NW NE SW Section 30, Denver Township, Isabella County, was treated with acid and brought up to 60 bbls. a day.

Yost Area Looks Spotted

Indications are that the Yost Pool in Greendale Township, Midland County, will not bring results expected. Drilling into water in the Dundee formation on

(Continued on Next Page)

Ritchie County, West Virginia, Well Increases Its Production to 300 Barrels a Day Natural

By STAFF CORRESPONDENT

PITTSBURGH, Pa., Mar. 27.—In Clay district, Ritchie County, West Virginia, the Lucky Strike Oil Co. completed a test on the Edgar Hinton farm, part of the old Robinson farm, during the latter part of February and it was reported as a fair producer having made 165 bbls. the first three days. Before a fair test could be had of the well the casing collapsed and repairs had to be made. After the hole had been cleared the well started to flow again at the rate of about 40 bbls. a day, which gradually increased to 90 bbls. a day. The flow then increased to 100 bbls. and the day following again made an increase and produced 300 bbls. natural.

The farm is just northwest of Harrisonville and in territory which had been well drilled along the two lines to the northeast. The nearest tests to it are either dry holes or gas wells both on the two lines, but this producer is located between lines of tests and may be considered in advance of production in that territory. The producing formation is the Injun sand, the top of which was struck at 1,815 feet, oil being found at 1,912 feet, and the final depth 1,916 feet. Two opinions are expressed, one is that it is a small pocket, and the other the beginning of an extension.

One new producer with an initial production of 10 bbls and three fair gas wells were completed in the Eastern fields. Two other wells found the sands dry. The best well for the week was in Southeast Ohio.

SOUTHEAST OHIO

In Perry County, Southeast Ohio, in the NW of Section 5, Bearfield Township, Hopewell Fuel & Gas Co. and others completed a test on the Clyde M. Foraker farm. It was drilled in the Clinton sand but 15 feet to a final depth of 3,600 feet and is a gas well gauging in excess of 2,000,000 feet a day. It will be deepened later.

The only other operation in Southeast Ohio was in Medina County, where E. R. Edson & Son Co. drilled No. 21 on the George W. Packard Lease No. 2 in Tract 14, Lot 3, Chatham Township. It was abandoned as a dry hole at a depth of 397 feet after the Berea grit failed of production.

The test of Benedum & Trees on the E. E. Knowlton farm in Section 10, Independence Township, Washington County, has now passed 7,500 feet and is drilling in pink shale and shells. The Clinton sand has not been located and the hole will be deepened.

In the deep sand districts a few wells are drilling. In Muskingum County, Wittmer Oil & Gas Properties are about due in with their test on the Sarah Miller farm in Section 11, Washington Township. In Licking County, McClay Brothers are drilling No. 3 on the George Boyd farm in Section 3, Perry Township. In Holmes County, Mehowa Oil & Gas Co. is in the sand on the B. J. Ulrick farm in Section 25, Hardy Township. In Hanover Township, Licking County, Edward H. Everett Co. has a rig standing for a second test on the Felix Claypool Lease No. 2 in Section 7. W. G. Perrigo Co. has abandoned its location for No. 6 on the J. A. and W. E. Donnelly farm in Section 1, Jackson Township, Perry County.

In Monroe County the Southerland Oil & Gas Co. is drilling on the W. A. Quigley farm in Section 9, Franklin Township. In the same township, Section 18, E. C. Cunningham and others are drilling on the Joseph Reed farm.

About 23 wells are actively drilling in Southeast Ohio, and there are seven rigs standing for tests.

WEST VIRGINIA

Except for the news of the Clay district, Ritchie County, strike in the 300-bbl. well, the week added little to completions in West Virginia. One producer was completed and two gas wells. One dry hole was reported.

In Grant district, Ritchie County, Doctor Moyers and others completed a test on the Newton Law farm in the Salt sand at a depth of 1,700 feet. It started off at 10 bbls. a day initial.

In Lincoln County, Pridemore and Adkins completed a test on the Lonnie C. Egnor farm in Jefferson district. It was drilled to the Berea sand and showed about 90,000 feet a day from that formation with an additional volume of over 400,000 feet a day from the Big lime. The total depth was 2,242 feet.

In Ritchie County, Russell Morris and others completed a test on the J. W. Westfall farm on Addison Run in Grant district. It is an Injun sand gas well at a depth of 1,911 feet and rates at about 500,000 feet a day. In the same district, but on the Lucy Jenkins farm on the waters of Cabin Run, H. N. Rinehart and others drilled a test through the Injun and Squaw sands and found them dry.

Drilling in West Virginia

In Cabell County only three wells are drilling. The head is off the boom in Guyandotte district where now only two wells are active. R. H. Adkins and others are down 250 feet on the E. H. Darnell and others lot, and C. C. Wolfe and others are down for casing at 1,330 feet in No. 5 on the Ben Lomond Land Co. tract. In McComas district, D. H. Campbell and others have reached 1,450 feet in a second test on the Gilbert Holton farm.

In Wayne County the Burgess Oil & Gas Co. is cleaning out after shot on the Robert Vaughn farm in Union district at a depth of 3,030 feet. In the same district the test of the Southern West Virginia Gas Co. remains shut down at 1,450 feet on the A. W. Preston farm.

In Boone County, C. P. Jones and others are rigging up on the R. W. McKinney farm in Scott district. In Putnam County the Teays Valley Drilling Co. is drilling on the C. H. Cottle farm in Scott district and has reached 1,315 feet.

New work in Calhoun County includes

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Central West Fields

(Continued from Preceding Page)

Pure Oil Co.'s No. 2-A, in the southwest corner of the Mattie Yost farm, Section 35, Greendale Township, a direct north offset to the producing Dundee well with an 1,150-bbl. initial record, indicates a spotty producing horizon in the southern part of Greendale Township. No. 2-A Yost when drilled into the Dundee tapped water and while there were both gas and oil production it was in limited quantities and practically drowned out by the water. Probably efforts will be made to plug off the water. It was not reported whether the water was coming from the structure that showed oil and gas. If it is coming from below a producing strata it might be successfully plugged off and the test made into a commercial well.

No. 2-A Yost marks the third Dundee completion made by Pure offsetting to the north, west and northwest. No. 1-A Yost was completed in December, 1932, at 1,150 bbls. a day. Production was last reported from 250 to 350 bbls. a day.

No. 1-B Yost, direct location west, was completed for 210 bbls. a day. No. 2-B Yost, due north from No. 1-B Yost location, produced around 70 bbls. with some water and was plugged back and completed for about 200 bbls. a day. When No. 1-A Yost was completed high hopes were attached to it as the forerunner of a valuable new producing area in Central Michigan. The Yost lease is about 4 miles south of the Chippewa-Greendale Pool.

Previous testing had given indications that production would be spotty and development of the Yost lease bears out this theory. No. 1-A Yost indicated that the area holds commercial possibilities and at least pockets containing large oil reservoirs. These pockets, however, may be widely separated and may not be spread out as in the other proven pools of Central Michigan.

There has been no well defined testing program to the southeast of the Yost lease and the theory is now entertained that the Yost producing structure extends in that direction. It is possible that either farther west or north more production may be found. Three tests now under way will show in a large measure what the district to the west, north and southeast holds in the way of oil production. Pure Oil Co. is testing No. 1 Anna Corning, NE Section 34, Greendale Township, a half mile north of the Yost. Same company is also testing No. 1 Martha Clark heirs, NE Section 2, Jasper Township, Midland County, a mile southwest of the Yost and on the line southeast trend between the Yost and Otway lease in Porter Township. Columbia Oil & Gas Co. is drilling on the Travis farm, SE Section 32, Greendale Township, 2 miles due west of the Yost. This well is reported running high on formation.

CENTRAL WEST

In Sandusky County, 11 wells were abandoned. In Washington Township, Zorn-Horning Co. abandoned No. 21 on the John Noss farm, in Section 20; No. 7 on the J. H. Neiset farm and Nos. 3 and 4 on the John Kirsch farm, same township. Ohio Oil Co. abandoned No. 12 on the Humburger farm, Section 30, and No. 9 on the Adam Humburg farm, Section 35, same township. In Sandusky Township Ohio Oil Co. abandoned No. 8 on the Felix Rafferty farm, Section 7. No. 4 on the A. Kreilick farm, Section 6, Rice Township, and D. L. Keiser abandoned Nos. 1, 2, 3 and 4 on the William E. Lehmann farm, Section 28, Scott Township. Montgomery and others are starting No. 2 on the N. F. Hetrick farm, in Rice Township.

In the Tiffin Field, Seneca County, Green and others drilled in a light gas well on the Mary McElhaney farm, Section 15, Hopewell Township, as did W. I. Gettman and others in No. 1 on the H. L. Crum farm, Section 12, same township. D. Lyons and others are drilling No. 2 on the James D. Watson farm, Section 1, same township, and Sandusky Gas Co. is drilling No. 1 on the Anna Shoull farm, Section 10, same township. In Jackson Township, same county, Ohio Oil Co. abandoned No. 2 on the William Boyd farm, Section 17.

CENTRAL OHIO

Seven completions were reported in the Central Ohio Field, two oil wells with an initial of 104 bbls., two dry holes and three gas wells. In Coshocton County, Perry Township, Huise & Kuntz, Inc.'s test on the Charles M. Dawson farm, Section 17, produced 66 bbls. initial from 3,127-85 feet. In Washington Township, Muskingum County, Wittmer Oil & Gas Co.'s test on the James E. Miller farm, Section 11, is good for 38 bbls. initial.

In Hopewell Township, Licking County, Wehrle Gas Co.'s No. 2 on the James M. Iches farm, Section 22, is reported dry at 2,537 feet.

In Berne Township, Fairfield County, City Natural Gas Works of Lancaster drilled in a gas well in No. 3 on the Albert Brannum farm, Section 30, at 517 feet, the Berea sand. Wiser Oil Co. is drilling on the Abraham Crowthers farm, Section 18, Perry Township, Coshocton County, at 900 feet.

In Stark County Jackson Township, East Ohio Gas Co. made a location on the Hoover Co.'s farm, Section 12, and for No. 1 on the J. A. and Celestie Shock farm, Section 7, same township. Kime and others are drilling No. 4 on the Charles A. Oberlin farm, Section 6, same township. Ohio Fuel Gas Co. drilled in a gas well in No. 1-5,704 feet on the Anna Gill farm, Section 18, Plain Township, same county.

Stoltz and others are starting a test on the Joe E. Beech farm, in Berlin Township, Holmes County.

Several wells are nearing the gas sand in Jackson Township, Stark County, the leading gas producing area. In Plain Township, Plain Natural Gas Heating Co. is drilling around 4,500 feet in No. 1 on the John Marquardt farm, Section 8, and White and others are down to 4,200 feet in No. 1 on the Celestia Kolb farm, Section 17, same township. East Ohio Gas Co. is drilling around 3,600 feet at No. 1 on the Stella Strausser farm, Section 18, Plain Township, Stark County.

Stoltz and others have a rig on the Joe E. Beech farm, Section 6, Berlin Township, Holmes County. Simms Oil & Gas Co. has a rig on the Ward Swetland farm, Lot 9,974, in Rusk Creek Township, Logan County.

INDIANA

Three fair gas completions were reported from the southwestern part of Indiana. The best was drilled by Claude E. Noble and others in the southeastern corner of the Helen Smith farm, SW Section 17, Washington Township, Pike County, which came in at from 1,024-40 feet. A. E. Daviess and others' test in the northeast corner of the J. M. Smith farm, SW Section 20, same township, topped the gas sand at 1,118 feet and found the gas at 17 feet in the sand, total depth 1,135 feet. Charles C. Talliaferro, Jr.'s test in the southeast corner of the Thomas Insman farm, NE Section 26, same township, the lightest of the trio, the Helen Smith well, being reported good for 2,000,000 feet. Three other wells are under way in Pike County. Harry N. Bell is drilling No. 1 on the Charles R. Lucas farm, NE Section 18, Washington Township; A. Vern Burden and others are drilling No. 1 on the Blythe Miley farm, Section 18, same township, and Tressler, Barnett and others or H. A. Moore are shut down on the Earl Reed farm, NW Section 1, same township.

In Sullivan County, Turman Township, Scott, Whitlock and others are reported shut down at 1,300 feet at a second test on the T. and K. Metzger farm, SE Section 4. In Washington Township, Greene County, A. R. Morris and others are shut down on the H. B. Brown farm, Section 9.

Elberfield Gas & Oil Co. is shut down on the Henry Minke farm, NW Section 28, Greer Township, Warrick County. Bert White is drilling on the David Arms farm, NW Section 23, Harrison Township, Daviess County. Pierson, Yeager and others are drilling on the Dr. John R. Wilson farm, SE Section 8, Prairie Creek Township, Vigo County.

Fred Brandt is nearing completion on the Huntington County Poor Farm, SW Section 26, Huntington Township, Huntington County, and if it should be a commercial oil producer it would liven up some of the other counties in the old Indiana Field.

ILLINOIS

Only one completion was reported from Illinois, Warner Brothers' test, 600 feet from the north and east lines of the Grant Jessup farm, Section 23, Honey Creek Township, Crawford County, which was a dry hole at 1,635 feet. Jones and others have a rig in for No. 1 on the C. A. Taylor farm, Section 2, same township, and in Prairie Township, same county, Price & Weger are drilling No. 1 on the H. Standfield farm, Section 36.

KENTUCKY

No completions were reported from Kentucky.

Hints of Practical Value

By L. G. E. BIGNELL

Petroleum Engineering Editor

Sand Tapping

Sand tamping above charges of explosives used in shooting wells has rapidly come into general use during the past few years. The following suggestions are given covering the details of this method because there are many who are not as yet familiar with it.

The shot is lowered into the hole in the usual manner and is prepared for exploding by the use of a timing bomb which is set to explode the shot some hours later. The hole around the torpedo may be left dry or filled with fluid to about 2 feet above the top of the bomb at the option of the shooter. This detail is determined by local conditions in the hole and in no way affects the sand tamping.

The first thing to do in preparing a sand tamp is to select a number of small pieces of bush or tree limbs about 3 feet long and bind them into a round bundle wrapped in a piece of burlap. A forked stick will also serve for this purpose if sufficient small material is not available. This bundle will form the lower bridge above the shot and should be of such size as to permit it being placed in the hole by lowering on the end of a bailer or light string of tools.

After the bridge has been placed in its position the next operation is to throw into the hole enough broken brick or tile to fill about 4 to 6 feet of space above the bridge. The bridge itself should be not less than 3 feet in length, therefore bridge and broken material will occupy about 7 to 10 feet of the hole next above the time bomb.

The fine moist sand is next poured into the hole and enough should be used to fill it at least 200 feet. More sand can be used if desired as it is not possible to get too much material above the shot but the use of too little tamping is to be avoided.

The sand used can be of the usual building grade free of gravel or coarse material. It should be moistened enough to pack firmly but not soaked with excess water.

The sand will pack in between the brick or tile above the bridge and when the shot is exploded its force will be directed against the formation instead of up the hole where it would do no good and perhaps might harm the casing.

After the shot the debris can be readily cleaned out of the well by the use of a light string of clean out tools and regular bailer. However, this work can be facilitated by the use of the newer type suction bailer if it is possible to fill the hole with oil or water sufficient to create a head of 400 feet above the bailer.

Test for Limestone

Production men are now interested in treating wells with acid and to determine in a preliminary way whether the formation from which the oil is being secured is suitable for such treatment something should be known about limestones.

Limestone is a rock that is composed chiefly of carbonate of lime. When limestone contains appreciable quantities of magnesia it is known as dolomite. The relatively pure limestone and the dolomite act differently when treated with dilute hydrochloric acid.

Drillers usually identify limestones by optic examinations of the cuttings. In many cases this is unsatisfactory as beds of gypsum and anhydrite have often been identified as limestone. The only reliable quick test for limestone is by the application of dilute hydrochloric acid. The dilute hydrochloric acid attacks all carbonates and causes effervescence or bubbling with rapid evaluation of carbon dioxide gas.

To examine a sample it is best to place a few drops of dilute hydrochloric acid in a flat glass and then let a few clean washed small fragments of the rock fall into this acid. Fragments of limestone will invariably effervesce in the acid promptly and actively. On the other hand dolomite or impure limestones will effervesce slower. The finer the fragments the more violent is the effervescence, so in making tests of different specimens pieces of rock of about the same size should be used in all cases.

For field experiments a clean flat glass or the bottom of a cup or saucer turned upside down can be used for this test. Then select clean fragments of the material to be tested and place them in the acid on the glass or cup and watch results carefully, under a magnifying glass, if necessary. In powdered condition, the material tested effervesces most rapidly, usually producing a froth if it is pure limestone. The strength of the acid generally used is 20 per cent and need not be further diluted with water for test purposes. The acid should be kept in a small glass-stoppered bottle.

Caliche, limestone, chalk and possibly marl and calcareous sandstones will effervesce briskly. Dolomite, possibly calcareous clay, marl or sandstones; clay, marl and sandstone will effervesce slowly. The rate of effervescence is determined by the percentage of pure carbonate in the sample and is the index to the possible use of acid in cleaning the well.

After the test has given general indications as to the possibility of applying acid to the well it is best to consult with a commercial service company doing this type of work or a commercial chemist to determine the exact amount and strength of acid to be used in the well.

H. G. BARNHURST DEAD

H. G. Barnhurst, 60, Middle West representative of the cement sales department of the Babcock & Wilcox Co., died in Chicago of heart failure March 18.

Humble's Test Defines Hobbs Pool to North as Skelly and Texas Co. Get Good Producers

By TOLBERT R. INGRAM
Staff Correspondent, Rocky Mountain Area

DENVER, Colo., Mar. 27.—The limits to the productive area of the Hobbs Pool on the north were defined in the Humble Oil & Refining Co.'s No. 1 Hardin, which swabbed 100 per cent water for 36 hours. The Texas Company's No. 4-C State, on the northwest flank, was completed for 9,351 bbls. of oil and 8,314,000 feet of gas. The Skelly Oil Co.'s No. 1 State, on the northeastern side, gauged 2,824 bbls. of oil plus 17 per cent water, and the Stanolind Oil & Gas Co. had a small well in the southeastern part of the field. Two new locations were made in the Hobbs Pool and one in the Jal area. Adoption of a 4-cent severance tax by the New Mexico legislature may be contested in the courts.

In Colorado, the Anthes test in Weld County is making fast time after straightening up hole. New regulations for measuring the volume of crude oil production from wells on the public domain will go into effect May 1. Morgan County may have another deep test this spring. State oil inspector asks for a legislative investigation of his office.

In Wyoming, a gas well in a fault block south of the Elk Basin Field, is estimated at 25,000,000 feet per day in the Wall Creek. The Mountain Fuel Supply Co. released two locations, the first of a series of six wells, in the Baxter Basin district.

In Montana, The Texas Company was high bidder for a block of Indian leases on the northwest trend of the Cut Bank oil development. The Santa Rita Oil & Gas Co.'s No. 1 Jackson was completed in the Cut Bank Field for 60 bbls. One new location was reported. Drilling has been resumed at Dry Creek.

NEW MEXICO

Lea County

The allowable outlet for the Hobbs Pool for the last half of March remains practically unchanged at 30,476 bbls. per day. The Shell Pipe Line Co. is the largest purchaser of crude in the field, its nominations for the period being 13,500 bbls. per day. The Shell Petroleum Corp. has 22 producers and from these the company is taking 3,921 bbls. The Humble Pipe Line Co. comes second with nominations for 9,630 bbls. daily while 15 wells on the Humble leases have a daily allowable of 3,472 bbls. The Atlantic Pipe Line Co. is taking 6,000 bbls., while two wells on the Atlantic leases are restricted to 212 bbls. The Texas Company is taking its own allowable of 1,291 bbls. from its eight wells and the Walker Oil Corp. is taking the remainder, 54 bbls. from its own wells. The potential for the field on March 16 was 1,237,687 bbls. from 190 wells on 170 units of 40 acres each.

Drilling operations which for the past six months have been extending outwardly from the producing area resulted the past week in finding the limits of the pool on the north in two wells. The Humble Oil & Refining Co.'s No. 1 Hardin, SW cor. NW Section 18-18-38, swabbed 100 per cent water for 36 hours from a total depth of 4,247 feet. It has been plugged back to 4,200 feet and will test. This location is half a mile due north of the Amerada Petroleum Corp.'s No. 1 Hardin, SW cor. Section 18, which was completed last June at a total depth of 4,158 feet and given a potential of 10,174 bbls. daily. The Humble well is three-fourths of a mile southwest of the Landreth Production Co.'s No. 1 State, SW cor. SE Section 7-18-38, which in the fall of 1930 was abandoned at 4,520 feet, having encountered sulphur water at 4,502-20 feet. The Landreth well is the farthest to the north of any test drilled in the district.

The other well showing water is the Amerada Petroleum Corp.'s No. 3 Hardin, NW cor. SW Section 18-18-38, a south offset to the Humble's No. 1 Hardin. It flowed sulphur water from 4,116 feet. The 7-inch has been cemented at 4,134 feet with 500 sacks and it is waiting.

The situation on the northwest flank showed up much better in The Texas Company's No. 4-C State, NW cor. NE Section 25-18-37, a little less than half a mile to the north and the same distance to the west of the nearest producers. It was completed at 4,232 feet and was given a potential of 9,351 bbls. per day. It gauged 8,350 bbls. net oil and 8,314,000 feet of gas, flowing open, and 1,948 bbls. and 2,349,000 feet through the tubing. This well is located more upon the trend of production in a northwest-southeast direction than the two water wells in the north and several locations to the northwest of this well may be productive.

The Skelly Oil Co.'s No. 1 State, C W half SW SW Section 17-18-38, in the northern end of the field and due east of a line of producers along the south line of Section 18, was completed as a producer at a total depth of 4,260 feet. It topped the Terry at 4,195 feet and reached the pay at 4,222 feet. It gauged 2,824 bbls. of oil, plus 17 per cent water, and 4,595,000 feet of gas, open flow.

Another completion, this one in the southeastern part of the field, is the Stanolind Oil & Gas Co.'s No. 26 Thorpe, C SE NW Section 10-19-38. It proved to be a small well and was given a potential of 130 bbls. of oil and 130,000 feet of gas per day from a total depth of 4,185 feet. It topped the Terry at 4,100 feet. In this same area, the Stanolind's No. 8 Capps, not far from the discovery well, reported a completion last week, gauged 1,231 bbls. of oil and 1,126,000 feet of gas per day at a total depth of 4,195 feet. The top of the Terry was at 4,067 feet and the pay at 4,092 feet.

Two new locations were made in the Hobbs Pool. These are the Stanolind Oil & Gas Co.'s No. 8 State, C NW NE Section 9-19-38, and the same company's No. 29 Byers, C SW NW Section 3-19-38.

In the Jal area, a new location was reported in E. B. Guess' No. 1 Conditt, C SW SW Section 12-25-36, half a mile to the north of the Continental Oil Co.'s No. 1-B Sholes, which was completed two weeks ago for better than 2,000 bbls.

In the Eunice area, the Atlantic Oil Producing Co.'s No. 1-B State, C NW SE Section 8-21-36, is drilling at 3,005 feet in lime and anhydrite. It had a show of gas at 2,951 feet, which increased at 2,970 feet. It topped the brown lime at 2,960 feet.

Eddy County

Harry Leonard and the Barnsdall Oil Corp.'s No. 1 Dodd, SW SE SW Section 22-17-29, in the Jackson area, which is drilling deeper after gauging 6,742,000 feet of gas per day at 2,307 feet, cemented the 6⅝-inch at 2,329 feet and is waiting. The gas is being saved.

R. Spearow and others' No. 1 McClellan, SW NW NE Section 22-22-23, Indian Creek, is bottomed at 1,528 feet. The 15½-inch and 10-inch have been pulled and reaming is in progress at 720 feet.

De Baca County

The Landowners Oil Co.'s No. 1 State, SW cor. NE Section 16-1s-27, Buffalo Creek, has resumed and is drilling at 5,711 feet in shale. It topped the white lime at 5,307 feet.

San Juan County

Fred Barrett's No. 1 Hart, Section 11-29-11, Fulcher Basin, is drilling below 400 feet. R. C. Oswell, who recently drilled in his second producer south of Aztec, is clearing ground for another test.

Oil Severance Tax

The New Mexico legislature passed shortly before adjournment a measure imposing a severance tax of 4 cents per barrel on crude oil. There was strong opposition to the measure, not only by operators, but on the part of those who felt that the welfare of the State was not best served by placing this burden upon the oil producers. The operators at present are producing 30,000 bbls. per day from the Hobbs Pool alone. This production moves through pipe lines into Texas and these lines all tap fields much nearer the ultimate destination than the Lea County pools. The oil men have taken much of this oil, which they did not need for requirements, in a spirit of co-operation with the State. The imposition of a fixed severance tax in addition to a gross production tax and a tax of 4 cents per gallon on lubricating oils, and the usual gasoline taxes, puts quite a heavy burden on a product which has to compete with markets more favorably located. It is probable that litigation will follow as the state constitution, it is contended, covers the subject in Section 1, Article 8, which reads: "Taxes levied upon tangible property shall be in proportion to the value thereof, and taxes shall be equal and uniform upon subjects of taxation in the same class." The tax as provided in the new law is 4 cents without regard to the price of crude, while in Texas it is 2 per cent of the gross receipts. It is claimed that a reported irregularity in formally adopting the measure paves the way for further testing of its legality.

COLORADO

A uniform method of measuring the volume of oil to determine the impurities in same which was recommended by the mineral leasing division of the U. S. Geological Survey will be put into effect for all production from wells on the public domain beginning May 1. The measurement of production from the public domain for determining the Government's royalty will be on the basis of 100 per cent of tank strappings, with full deduction for allowance impurities, corrected to 60° F. in accordance with Table 2 of Circular 154, and the supplement thereto, of the U. S. Bureau of Standards. The new ruling, promulgated by the Secretary of the Interior, does not disturb the prevailing pipe line practice of running crude oil on the volume basis and making percentage deductions for basic sediment, but applies only to the oil produced on government land on which the Government receives royalty. Approximately 85 per cent of the production on the public domain is already measured on the basis which will on May 1 become uniform on all government land. The order was originally issued last August, effective October 1, but was suspended by Secretary Wilbur pending a hearing requested by the Rocky Mountain Oil and Gas Association, the Mid-Continent Oil and Gas Association, the American Petroleum Institute, and others. Following a hearing, the Secretary on March 3 sustained the order issued last fall.

Weld County

The Continental Oil Co. and others' No. 1 Anthes, C NE NE Section 24-8n-59, Buckingham district, is making much faster progress since straightening up the hole and at last reports was drilling at 4,755 feet. Acid botle tests show that the hole is less than 1 per cent off of vertical. String of 7-inch pipe is being moved in from the No. 1 Niles well, which recently was abandoned. It is planned to set the 7-inch on top of the Muddy and change over to cable tools.

Morgan County

Negotiations are reported pending looking to the drilling of a test on the Clem Lee and Dr. A. C. Lusby block of 11,000 acres, 5 miles southeast of Fort Morgan. This was disclosed recently when A. J. Hardendorf, of Denver, and associates, asked the Fort Morgan city council to delay any action looking to the granting of a natural gas franchise to any concern until the syndicate was given an opportunity to test the structure, known as the Roundtop Dome. The Midwest Refining Co. had an option on the block two years ago and did extensive core drilling to work out the structure. It did not exercise its option, however, due to a change in its exploration policy. William A. Myers then made a deal for the block and dug a cellar in the C NE SW Section 6-2n-56, but was delayed in drilling beyond the contract date. Judge Fred W. Freeman was working out a plan for a test last year when he died. Hardendorf and associates are then reported to have entered the picture. H. C. Brettschneider, formerly vice president of the Midwest Refining Co., and interests identified with the Saltmount Oil Corp., are reported associated with Hardendorf in the deal and a major company recently began a survey of the structure. A well was drilled on the structure a number of years ago and stopped in sandy shale at 1,750 feet. The log is said to have shown the structure to run about 850 feet higher than the Indian Territory Illuminating Oil Co.'s test on the east flank of the Fort Morgan arch. In fact, there are indications of it being about the highest of any large block geologized in that area.

Boulder County

Consolidated Smelting & Metals Co.'s No. 1 Blubaugh, SE cor. Section 20-3n-70, Lyons district, is drilling at 380 feet.

Larimer County

C. Leonard Smith and others' No. 2 Union Pacific, SW cor. Section 31-12n-69, Sand Creek, is drilling at 360 feet. A water sand encountered in No. 1 is expected within the next 100 feet after which the hole will be dried up with the 8¼-inch.

Fremont County

The Cherry Creek Placer Co.'s No. 1 Lucas, SW cor. NE Section 32-18-69,

Florence district, is shut down for casing at 1,300 feet.

Archuleta County

The Oil City Petroleum Co.'s No. 4 Crowley, C S L Section 11-32n-1e, Chromo district, which attracted attention several weeks ago when it was reported showing oil, followed by artesian water, is still an unknown quantity. A party who made an investigation said the well was making about 100 bbls. of water per day at a depth of 204 feet and that there was a show of oil with the water. He did not attach much importance to the reported strike.

Refinery Operating

The Colorado Oil Refining Co., in which C. Leonard Smith is the principal party in interest, has placed in operation its new refinery on Federal Boulevard, just north of Denver. The plant has a charging capacity of 350 bbls. daily, which is being increased to permit continuous operations. Crude at first was shipped from the Osage Field in Wyoming, but is now coming from East Texas.

Requests Investigation

Colorado State Oil Inspector James Duce has requested the presiding officers of the senate and house of the Colorado legislature to make an investigation of his department as a result of charges of extensive bootlegging of gasoline in the state. In his request he says he has been advised that certain interests and lobbyists have caused to be circulated generally vague rumors and assertions of extensive bootlegging due either to fraudulent operations of the office of state inspector in connivance with such bootlegging or negligence in failing to detect and collect tax upon same. He says that if any such evidence of facts exist that they should be made public and charges that the rumors are put out to discredit the efficient administration. No action has been taken on the request up to this time.

WYOMING

Park County

A flow of gas estimated at 20,000,000 to 25,000,000 feet per day was opened up the past week in the South Elk Basin district in the Henderson Production Co.'s No. 10, SW NE NE Section 31-58-99, in the second Wall Creek in the Frontier formation. This well, which was located by Petroleum Information, Inc., of Denver, as a test of a 160-acre fault block south of the Elk Basin Field, encountered 6,000,000 feet of gas in the first Wall Creek last fall at a total depth of 1,820 feet. The 8¼-inch was run to bottom and cemented and operations were suspended for the winter. Operations were resumed 10 days ago and the well was cleaned out to bottom. It then drilled through the hard shell on top of the second Wall Creek and more gas came in. It was estimated at 10,000,000 feet. A 6-inch shell was penetrated at 1,848 feet and the hole cleaned itself of drilling water. At 1,867 feet it was estimated at 15,000,000 to 20,000,000 feet and further increases continued to the total depth of 1,875 feet when the well was shut in for a conference of officials. It was still in sand when drilling stopped. Elk Basin produces light oil from the Frontier sands and three big gas wells which supply Billings and other Montana towns are in the Dakota. The Henderson well is believed to be the largest in the Frontier completed either in the field proper or the south field in the past 10 years.

Sweetwater County

The Mountain Fuel Supply Co., the producing company for the Western Public Service Corp.'s gas line into Utah, has made locations for two wells in the Baxter Basin district which are the first of a series of about six wells to be drilled this year. Cellars have been dug for No. 2 Mullen, Section 2-17-104, South Baxter Basin, and No. 2 Cappers, Section 12-19-104, North Baxter Basin.

Fremont County

The Texas Company's No. 2 State-Ridgway, SE SW SW Section 36-34-95, Alkali Butte, was deepened to 5,460 feet before starting to plug back to test sands in the Sundance and Morrison formations. A sand in the Morrison at 4,616 feet gauged 6,000,000 feet per day when tested on the way down. The Lakota contained water and the Dakota was not in place. It had a little dead oil, gas and salt water in the Muddy.

The Kinney-Coastal Oil Co.'s No. 3 Enos, SE cor. NW Section 22-3n-1w, Pilot Butte, cemented the 8¼-inch at a total depth of 821 feet and is preparing to test a show of oil.

Plans for opening the Maverick Springs fields by building a pipe line to a rail connection probably will be the subject of considerable negotiations before any definite decision is reached. George E. Brimmer, of Cheyenne, was granted a permit for a 33-mile pipe line two weeks ago. It is understood that negotiations look towards the construction of a railroad from the Burlington and Chicago & Northwestern lines at Shoshoni and Bonneville to Pavillion, the proposed terminal of the pipe line. Both projects may be undertaken by a single corporation to be formed. The Secretary of the Interior issued a departmental order on February 28 requiring the operators to begin marketing their oil by September 1, or possibly face a suit for cancellation of leases.

Carbon County

The Ohio Oil Co.'s No. 1 Haslett, SW Section 34-23-79, Allen Lake, is rigged and ready to spud as soon as weather conditions are favorable.

Albany County

S. Marvin James & Co.'s No. 1 Hindry, C SW SW Section 10-13-76, Riverside district, is bottomed at 510 feet and underreaming the 10-inch to carry to 260 feet for a water shutoff. Two joints of surface pipe were run and the water will be saved between casings.

Platte County

T. R. Oberman's No. 1 Diamond ranch, NW SE Section 30-21-68, west of Chugwater, is drilling at 475 feet.

Niobrara County

The Interstate Oil & Refining Co.'s No. 1 Morrell, NW NE SE (cor.) Section 2-39-61, West Mule Creek, has recovered tools and is reaming at 2,230 feet.

Weston County

The General Oil Co.'s No. 1, NE NW SE Section 22-46-64, Osage Field, cemented the 8¼-inch at 1,600 feet and is waiting. The Lincoln Oil Syndicate's No. 1, SW cor. SE Section 10-46-64, is resuming at 1,250 feet.

Crook County

The St. Onge Oil & Gas Co.'s No. 1, SW NE SE Section 20-53-61, Redwater district, is resuming at 900 feet.

MONTANA

Carbon County

The Ohio Oil Co.'s No. 9 Souders, C NE SW Section 2-7s-21, Dry Creek, which has been shut down for several weeks at 4,625 feet on account of water shortage, has resumed and is making hole at 4,635 feet. It is probable that the completion of this well will end the company's drilling program for the remainder of this year.

Glacier County

The Texas Company was the successful bidder on a tract of Blackfeet Indian leases in the Cut Bank area at an auction sale at Browning this week. The block comprises 2,127 acres in Sections 29, 30, 31, 32 and 34-35-6w; and Sections 3, 5, 6, 8 and 10-34-6w, some of which is directly on the northwest trend of the developed production and the other to the north and northwest of W. M. Fulton and others' No. 1 Haggerty. The purchase price has not been received here. The lease carries drilling obligations.

One completion in the Cut Bank Field was reported in the Santa Rita Oil & Gas Co. and E. J. Lesser's No. 1 Jackson, C NW SW Section 25-34-6w, which is pumping 60 bbls. per day from a total depth of 2,920 feet. It proves up about a mile of territory between this location and No. 2 Yunck. The Stewart sand was cut at 2,865-96 feet and the Darling sand at 2,896-2,914 feet. There was no break between the two sands. It was shot with 20 quarts and then with 80 quarts at 2,896-2,916 feet.

One new location was reported in R. C. Tarrant's No. 2 Haglund, Sr., C NW SE Section 13-34-6w, which is rigging.

The Santa Rita Oil & Gas Co.'s No. 1 Tribal, C SW NE Section 15-35-6w, is drilling at 2,010 feet in the Colorado shale, and the same company and P. T. Sweeney's No. 1 Jacobson, C NW NW Section 23-37-5w, began spudding March 17. This well is far to the north near the Canadian line.

R. C. Tarrant's No. 1 Hope, C SW SW Section 18-34-5w, is rigging up, and his No. 1 Miller, C NE NE Section 24-34-6w, is ready to resume at 1,250 feet. Same operator's No. 1 McLellan, SE SW SW Section 7-34-5w, on the northeastern side towards the gas area, which was reported a 900,000-foot gas well last week, has been completed and is making 1,500,000 feet of gas and 6 bbls. of oil per day.

W. M. Fulton and others' No. 1 Haggerty, NE cor. Section 16-34-6w, topped the Colorado shale at 645 feet, cemented the water string at 655 feet and is drilling at 680 feet. The Hannah-Porter Co.'s No. 1 Britton, NW NE NE Section 23-34-6w, is drilling at 550 feet. The Alberta-Pacific Consolidated Oil Co.'s No. 1 Kiesel, NE cor. NW Section 11-34-6w, is drilling at 2,750 feet and carrying the 6⅝-inch at 2,697 feet with a hole full of salt water.

Toole County

S. V. Day's No. 1, E half NE Section 17-35-2w, Kevin-Sunburst Field, is a location.

South Turner Valley Producer Has Indications of Exceeding Early Production Estimates

By VICTOR LAURISTON
Staff Correspondent, Canadian Fields

CHATHAM, Ontario, Mar. 25.—In the South Turner Valley, Mar-Jon-Freehold's No. 1, LSD 9, Section 28-18-2w5, gives indications of considerably exceeding early estimates of around 450 bbls. a day. The well is the largest individual producer in Turner Valley and extends the proven area a considerable distance to the south. The test was drilled to 5,845 feet, and though the main porous horizon of the lime was apparently not reached, in view of the large production the hole is not likely to be carried deeper at present.

Another test is to be started soon by Pacalta Oil Co. in LSD 7, Section 28-18-2w5, southwest of Mar-Jon-Freehold's No. 1.

Hoffar-Lundy Test

Still farther south, Hoffar-Lundy Syndicate's No. 1, LSD 13, Section 22-18-2w5, is making good time running three tours. Henry S. Hoffar and Frank D. Lundy are backing the venture which will be a test of the deep lime.

Union Drilling Co.'s No. 1, LSD 8, Section 21-18-2w5, has resumed drilling after an all-winter shutdown at 100 feet. It is the farthest south in the field, a mile south of Mar-Jon's No. 1.

Mercury Tract

At Section 5-19-2w5 Miracle Oils' No. 2, LSD 16, rotary equipment is being installed and the test will probably resume drilling in April. It has been standing at 5,598 feet for about a year and was reported to have a small production of light crude oil from the naphtha horizon.

New Tests Possible

While several new tests have been started in the far south end of the field in the past few months, additional new work is regarded as probable this season. The relaxation of the regulation prohibiting new drilling to the lime is expected to stimulate activity to some extent. There has been considerable quiet investigation of various undrilled tracts in this area in the past few weeks. A potential area likely to be tested is LSD 4, Section 28-18-2w5, held by Model Oils, Ltd.

Shareholders of Hargal Oils, Ltd., at Vancouver elected the following directors: S. H. Smith, Edmonton; S. W. Miller, Dr. R. B. Boucher, D. B. Manley, H. G. Eakins and Harry G. Morris, all of Vancouver.

Milk River Test Abandoned

In the Border fields, Commonwealth Petroleum's No. 1, LSD 8, Section 9-3-15w4, which recently resumed work, has been abandoned after drilling to 5,310 feet. Six gas sands were encountered between 2,730 and 4,223 feet and an oil show at 2,745 feet, just below the top of the Madison, corresponding to showings in the Texas-Imperial, Twin River and Keko Lake wells. Top of the Blairmore was at 2,160 feet, Sunburst sand at 2,570 feet, top of the Ellis at 2,610 feet and the Madison at 2,740 feet. Since 3,840 feet the drill has been working in various horizons of the Devonian lime where additional oil and gas shows have been met. The test established a new record for geological depths in the Border area of southern Alberta.

Twin River Test

On the Twin River structure, southwest of Lethbridge, Nordon-Roney's No. 2 Twin River, LSD 11, Section 2-2-20w4, is below 1,225 feet.

Cut Bank Field

On the Montana side, Alberta Pacific Cosolidated's No. 1 Matson, SE NW Section 14-34-6w, is reported at 2,910 feet and swabbing about 90 bbls. a day.

Recently completed producers include Adams-Mannix's No. 1 Britton, SE SE NE Section 14-34-6w, bottomed ot 2,890 feet and reported pumping 50 bbls. a day; Dakota-Montana Oil Co.'s No. 1 Drumheller, SW SW NE Section 3-34-6w, finished at 2,965 feet, pumping 60 bbls.; and L. R. Hannah's No. 1 Britton, SW SE Section 14-34-6w, bottomed at 2,897 feet, pumping 70 bbls.

An interesting new test is that of P. T. Sweeney and associates on the Lee

Jacobson ranch, NW NW Section 23-37-5w, in the Kerner section. This is 6 miles north of The Texas Company's No. 1 Peterson, the farthest north of the Cut Bank producers; and is southwest of the Montana end of the Red Coulee Field.

Burning Gasser Extinguished

In the old Bow Island Field, Canadian Western Natural Gas Co.'s No. 7, LSD 4, Section 24-6-11w4, which has been used as a storage well in connection with the company's program of repressuring the old field with Turner Valley gas, caught fire recently from a friction spark. The cap was shot off the well by marksmen with steel-jacketed bullets and after ordinary fire-fighting equipment from Bow Island and Burdett had been used unsuccessfully, a special boiler was fitted up and a jet of steam and chemicals directed on the flames, eventually bringing them under control and permitting the well to be capped. Some damage was done to machinery and equipment.

Drilling in Ontario

In the Ontario fields, Vacuum Gas & Oil Co.'s No. 5, Lot 53, South Talbot Road, is reported shut down at 1,500 feet. No rock salt has been encountered in the Salina formation, and the test has been logging about 20 feet higher than Vacuum's No. 4, which was 3,600 feet north. The latter got its gas at 1,580 feet.

It is reported that Toronto interests headed by E. P. Rowe are planning to drill a deep test in Dover Township, Kent County. Some of the Dover wells are still producing, and it is the belief of some operators that a larger field exists at a distance from the proven area. The proposed new well may test one of these outlying structures.

Lambton County

In Lambton County Union Gas Co.'s No. 66, Lot 22, Concession 6, Sombra Township, is reported drilling below 2,000 feet and looks like a dry hole. This test has logged somewhat deeper than the wells in the Dawn gas field 6 miles northeast.

In the northern part of Lambton County, it is understood the deep test planned by the British Petroleum Co. in Plympton Township near Aberarder will be carried into the Trenton formation. Tentative location has been made on the Archie MacKinlay farm, but it may be changed. The British Petroleum Co. is headed by Doctor Blain of Hamilton. The location is south of Kettle Point on Lake Huron where large outcrops of oil shale occur. Drilling to around 3,000 feet is contemplated.

Southwest Texas Fields

(Continued from Page 104)

moving farther to the southwest and will drill another hole.

Kerr Test Starts

J. E. Anderson set 12½-inch surface casing at 648 feet in No. 1 Witt in southeastern Kerr County, south of Center Point, and resumed drilling again and is last reported at below 700 feet. He has a big rig and is counting on going deep. The location was carefully worked out and is said to be on one of the most promising structures north of the Balcones Fault. Some new attention is being given this district with this well starting up and another test to be drilled in western Kerr County. The Anderson test was started by Halbert of Fort Worth and was carried for a time as the Verde Oil & Gas Co.'s No. 1 Witt and drilled to 118 feet where it stood for more than a year without progress. The Pennsylvania is the formation that is counted to pay off in this and other tests in Kerr County. Anderson has a big heavy duty cable tool rig and is equipped to go deep.

Government Wells Allowable

At a hearing before R. D. Parker of the Oil and Gas Division of the Texas Railroad Commission held in San Antonio relative to the allowables in the Government Wells pools in Duval County nominations were made for increased amount of production, and The Texas Company, which has production of its own in the field but has not heretofore been a purchaser, indicated its intention to enter the market. It has already built a gathering system and Humble Pipe Line Co. has extended its line to the North Government Wells Pool which heretofore has been run entirely by the Magnolia.

Crown Central Petroleum Co. increased its nominations from 32,000 bbls. monthly which it has been taking, the oil being delivered through the Humble pipe line, to 75,000 bbls. monthly and asked that the Sarnosa and South Government Wells Pools be declared separate pools and that each pool's allowable be fixed without reference to the other pool.

Magnolia Petroleum Co. increased its nominations from 5,500 bbls. to 6,500 bbls. daily, an increase of about 30,000 bbls. per month.

Some testimony was introduced to the effect that restrictions on the production in the field were hastening the water intrusion in the field.

Anticipates Constructive Trend on Eastern Coast

(Continued from Page 34)

due largely to a contraction in shipping operations, but as East Coast refiners have not overproduced Diesel oil, the market position remains steady. The posted price of $1.65 per barrel, f.o.b. terminals, is being adhered to on both contract deliveries and spot sales.

In so far as shore deliveries are concerned, refiners report that some improvement in inquiry is beginning to make itself manifest, and the outlook for this division of the market over the balance of the year is regarded in a favorable light. For shore delivery refiners quote 26-30 gravity Diesel oil at 4 cents per gallon in tank car lots, f.o.b. terminals.

Furnace Oil

Although the heating season is nearing its end, furnace oil volume spurted during the past week, and tank car movement was heavier than was the case during the previous week. Refiners continue to post 5 cents per gallon for 36-40 gravity oil, 4 cents for 32-36 oil, and 3½ cents per gallon for 21 gravity industrial heating oil.

Tank wagon furnace oil quotations were unchanged during the week, in so far as the major marketers were concerned, although some of the smaller marketers, in the vernacular of the trade, were reported to be "chiseling" and cutting the market by about a half cent per gallon. Marketers have not yet announced their contract prices for the 1933-1934 heating season.

Paraffin Wax

Wax markets were showing a steady undertone during the week, with prices remaining unchanged on all melting points. Export business was along somewhat broader lines, buyers who had been holding off the market in recent weeks coming in to cover prompt shipment requirements.

Export inquiry was fairly active last week, although bid prices on both crude scale and refined grades continued under the market.

Routine activity was reported in petrolatum during the week, with quotations unchanged on all grades.

Lubs

Refiners reported a slight improvement in the export call for cylinder oils for nearby shipments, and the market was showing a steadier undertone. Bright stock, No. 8 color, was steady at 23 cents per gallon (with 23½ cents asked in some instances), while No. 6½ color, dil., held unchanged at 22 to 22½ cents. On 600 "E" oil, the market was firmer at 18 cents. Sellers reported that more export inquiry was in the market for the entire list of cylinder oils, and a slow but steady expansion in foreign sales is anticipated. France is expected to furnish keener competition in British and Continental markets later in the year when the French refineries of the affiliates of Socony-Vacuum and Standard Oil of New Jersey are completed and in operation.

Neutral oils were also sharing in the improved lub oil market sentiment during the week, and prices remained steady and unchanged on both red and pale oils. More export inquiry is in evidence, and refiners are looking for a better movement of these oils into foreign channels from both New York and the Gulf.

In the domestic lub oil market, volume of business is showing seasonal expansion, although the retail situation is still giving trouble.

Eastern Fields

(Continued from Page 107)

the start by F. F. McIntosh of a test on the Charles and John Davis farm in Lee district. The depth is 265 feet. This operator has abandoned his location for No. 3 on the Fox and Morgan lease, same district. In Sheridan district, W. T. and O. L. Yoke are close to the sand in their test on the A. P. Yoke farm and have shut down at 1,924 feet to run casing. In the same district, L. B. Carroll is down 1,875 feet on the Pell Shank farm. In Sherman district, C. B. Lewis and others are building a rig on the W. T. Kelly farm. C. A. Jarvis and others have reached 1,820 feet on the Ida M. Whipkey farm, and Poling and Mollahan 1,875 feet on the A. Simons farm. In Center district, W. A. Bickerstaff has a rig standing on the Edward Gainer farm, and W. H. Bickel is drilling at 1,800 feet in a second test on the George D. Starkey farm.

In Roane County the second test of the Reedy Oil & Gas Co. on the E. S. Guthrie farm in Curtis district has reached 640 feet. In Gilmer County, A. E. Ellis and others have shut down their test on the L. H. Lydick farm at 1,560 feet, running casing.

In Wetzel County the Browns Run Gas Co. has reached 1,910 feet on the James Marshall farm in Clay district. In Marion County, Snodgrass and others are still fishing for the tools in their No. 1 on the Absalom Holbert farm which was being drilled to deeper sands. The depth is 2,895 feet.

SOUTHWEST PENNSYLVANIA

No completions were recorded in Southwest Pennsylvania. In Amwell Township, Washington County, with all Fifth sand wells being so far successful, operations are waiting on the completion of the Wise Oil & Gas Co.'s test on the John Roach farm. This will assist in judging the directional limits of the pool.

As in the case of the pipe lines in Southeast Ohio, the curtailment continued over so long a period has reduced stocks of crude available for shipment, and except for one pool has acted as a deterrent towards new search for oil sands. Thus the present time finds decreasing runs. Allegheny, Greene and Beaver Counties appear void of drilling operations, the only work being in Washington County.

At the present time all wildcat work in lower West Virginia and Virginia is shut down on account of impassable conditions.

Kansas Fields

(Continued from Page 101)

feet. T. M. Deal's No. 1 Kenrich, NE cor. NW Section 27-32-4, made 50 bbls. from 2,318-68 feet.

Greenwood County

Mendenhall's No. 5 Johnson, NW cor. NE NE NE Section 8-25-13, is a rig. Reeser and others' No. 1 Burney, SE cor. SW SW SW Section 3-25-12, was abandoned at 1,955 feet.

Harvey County

Continental Oil Co.'s No. 1 Pauls, C NW NE SW Section 12-22-3w, is a rig. Shell Petroleum Corp. and others' No. 1 Schmidt, NE cor. NW SW Section 17-22-3w, is a rig. Same company's No. 2 Schmidt, C NW SW Section 17-22-3w, is a rig. Imo Oil & Gas Co.'s No. 2 Lehman, NW cor. NE SE Section 35-22-2w, is a rig. Magnolia Petroleum Co.'s No. 1 Schmidt, NE cor. NW NE Section 30-22-3w, is a location. United Petroleum and others' No. 1 Thieson, NW cor. Section 29-22-3w, is a location. Sinclair Prairie Oil Co.'s No. 1 Edgar, NE cor. SW Section 19-22-3w, is a location. Frost, Study and others' No. 3 Martens, NE cor. SE SE Section 19-22-3w, is a location. Same operators' No. 2 Martens, SE cor. NE SE Section 19-22-3w, made 500 bbls. in six hours from 3,441-80 feet. F. Hollow and others' No. 1 Schmidt, SW cor. SE NW Section 17-22-3w, made 1,690 bbls. in 20 hours from 3,435-63 feet. Mabee, Inc.'s No. 2 Martens, SE cor. NE SE Section 19-22-3w, made 563 bbls. in one and one-half hours from 3,192-3,225 feet. Same company's No. 3 Martens, NW cor. NE SE Section 19-22-3w, made 275 bbls. in one hour from 3,175-3,212 feet. Producers & Refiners Corp.'s No. 1 Martens, NE cor. NW SE Section 19-22-3w, made 250 bbls. from 3,163-3,208 feet. W. C. McBride, Inc.'s No. 3 Freison, SW cor. NW NW Section 20-22-3w, made 2,400 bbls. from 3,500-06 feet. Same company's No. 4 Frieson, CNL SW NW SW Section 20-22-3w, made 2,400 bbls. from 3,482-95 feet.

Kingman County

Skelly Oil Co.'s No. 2 Miles, C S half S half NE Section 30-27-10w, is a location.

McPherson County

Youker and others' No. 4 Gratton, NW cor. SW Section 25-19-2w, is a location. Palmer and others' No. 3 Riley, SW cor. NE NW Section 7-20-1w, is a rig. The Texas Company's No. 3 Nachtigal, NE cor. SW SW Section 21-21-3w, is a location. Derby Petroleum Co.'s No. 4 Neufeldt, SW cor. NE SW Section 21-21-3w, made 575 bbls. from 3,403-28 feet. Mabee and others' No. 2 Koehn, NE cor. SE NE Section 33-21-3w, made 732 bbls. from 3,460-74 feet.

Reno County

Olson Oil Co. and others' No. 1 Gorvin, C NE SE Section 35-23-4w, is a rig. Same operators' No. 2 Krehbiel, C SE NW Section 26-23-4w, is a location.

Sedgwick County

Gypsy Oil Co.'s No. 6 Hamant, SE cor. NW NW Section 14-26-2, old well drilling deeper, total depth 2,865 feet, rigging. Aylward and Shell Petroleum Corp.'s No. 1 Eidwein, SE cor. SW SW Section 11-26-2, made 670 bbls. from 2,847-76 feet.

Sumner County

Watchorn Oil & Gas Co.'s No. 1 Rosecrans, SE cor. SW SE Section 17-35-2, was drilling at 1,600 feet.

THOMAS J. McKINNEY KILLED

The death of Thomas J. McKinney followed closely that of his wife, as a result of an automobile collision at Orlando, Fla., on Sunday, March 11. Their 9-year-old son was in the McKinney car at the time of the collision but was not seriously injured. Mr. McKinney was a retired oil man, widely known and highly esteemed. He had lately become prominent as an owner of fast harness race horses. He was a son of the late J. C. McKinney of Titusville and was a brother of L. C. McKinney of that city.

MORE CARS BACK ON ROAD

Idle motor vehicles, known in many states as "frozen assets" since they pay no taxes because they are not used, are being put back on the roads by thousands in Oregon and South Carolina by the simple expedient of postponing the registration date, or reducing license fees.

DEATH OF FRANK M. SHAY

Frank M. Shay died at Whittier, Calif., Friday, March 17, of heart disease. Mr. Shay was a prominent drilling contractor in the Bradford Field in Pennsylvania until 10 years ago when he moved to California and settled in Whittier. Mrs. Shay, three daughters and one son survive.

Gulf Coast Fields and Wildcats

(Continued from Page 103)

Yount Lee Oil Co.'s No. 39 Chambers County, Wm. Bloodgood Sur., 150 ft. N of No. 3 and 50 ft. E of W line ..... Coring sand and shale showing oil 5,377 ft.

Yount Lee Oil Co.'s No. 21 Chambers County, Wm. Bloodgood Sur., 175 ft. N of No. 20 and 50 ft. E of W line ..... Sand 4,524-42 ft; cmtd. 7⅝-in. csg. 4,714 ft.

LOST LAKE—CHAMBERS COUNTY

Pure Oil Co.'s No. 17 Mayes, F. H. R. Wallis Sur., 400 ft. NE of No. 14 ..... Drlg. sticky shale 1,029 ft.

RABBS RIDGE—FORT BEND COUNTY

Cullen & West's No. 1 Whitemore, Samuel Kennedy Sur., 231 ft. W of E line, 467 ft. N of S line of lease.. Drlg. 600 ft.

Gulf Prod. Co.'s No. 4 Jack Gubbels, Samuel Kennedy Sur., 1,756 ft. along E line from SE cor. and 2,-371 ft. W at right angles ..... Drlg. gumbo 2,365 ft.

Humble O. & R. Co.'s No. 6 Mary Gubbels, Samuel Kennedy Sur., 516 ft. from N line, 427 ft. from W line of tract ..... Drlg. shale 3,826 ft.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 6 T. R. Booth, 6,152 ft. E along N line of John Rabb Sur., from NW cor. of E½ and 2,454 ft. S at right angles.. Drlg. lime 2,693 ft.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 7 George, J. Rabb Sur. ..... Drlg. shale 4,522 ft.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 8 Lockwood, J. Rabb Sur. ..... Drlg. shale 4,875 ft.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 9 Lockwood, J. Rabb Sur., 6,286.5 ft. from W line, 511.6 ft. from N line of tract ..... Drlg. shale 2,513 ft.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 13-A Lockwood & Sharp, J. Rabb Sur., 4,174 ft. E, 533 ft. S of NW cor. of lease ..... Coring shale 5,259 ft.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 14-A Lockwood & Sharp, J. Rabb Sur., 4,175 ft. from W line, 526 ft. from S line of lease ..... Derrick.

Humble O. & R. Co. and Gulf Prod. Co.'s No. 16-A Lockwood & Sharp, John Rabb Sur., 833 ft. E of No. 15-A ..... Drlg. shale and lime 3,769 ft.

ORCHARD—FORT BEND COUNTY

Gulf Prod. Co.'s No. 35 Moore, Mark Smith Sur. ..... No report.

SUGARLAND—FORT BEND COUNTY

Keiman Prod. Co.'s No. 1 Peterson, Wm. Littel Sur., 100 ft. SE, 100 ft. SW of NE cor. of tract ..... Set 75 ft. of screen 3,756 ft; coming in; no production report.

HIGH ISLAND—GALVESTON COUNTY

Yount Lee Oil Co.'s No. 3 Broussard, M. Dunman Sur., 150 ft. E of center of W line of tract ..... Drlg. shale 6,010 ft.

Yount Lee Oil Co.'s No. 34 Cade, N. Fitzsimmons Sur., 884 ft. S of No. 33 ..... Oil sand 5,169 ft.

Yount Lee Oil Co.'s No. 35 Cade, N. Fitzsimmons Sur., 600 ft. S of No. 34 ..... Rig.

ARIOLA—HARDIN COUNTY

Republic Prod. Co.'s No. 3 Ariola fee, Ariola Sur., 400 ft. S of No. 1 ..... Tested S.W. 2,360 ft; drlg. deeper.

BATSON—HARDIN COUNTY

Danciger O. & R. Co.'s No. 1 Hooks, 95 ft. S, 150 ft. W of NE cor. of Strip 13, Donoghue Sur. ..... Gumbo 1,103 ft; cmtd. 10-in. csg.

SARATOGA—HARDIN COUNTY

Rio Bravo Oil Co.'s No. 94, Jordit, Jordit Sur., 200 ft. N of No. 89 ..... Set screen 601 ft; rigged up to pump.

MYKAWA—HARRIS COUNTY

Crown-Framer Oil Co.'s No. 4 Minnetex, 165 ft. S, 120 ft. W of NE cor. of Blk. 193, Wm. Lovett Sur. ..... Sand 4,912 ft; cmtd. 9⅝-in. csg. 4,870 ft.

PIERCE JUNCTION—HARRIS COUNTY

Rio Bravo Oil Co.'s No. 26-A Settegast, J. Kopman Sur., 1,210 ft. from N line, 750 ft. from E line of "A" lease ..... T.D. 5,928 ft; plugged to 5,843 ft; set 45¾ ft. of 4½-in. screen; swabbing.

Rock Drlg. Co.'s No. 1 Herman Est., J. Kopman Sur. No. 44, 785 ft. from E line, 35 ft. from N line of tract ..... Rigging up.

ESPERSON—LIBERTY COUNTY

Cranfill-Reynolds Co.'s No. 10 Moore's Bluff, M. Duncan Sur., 1,800 ft. from E line, 2,100 ft. from N line of 632-ac. tract ..... Drlg. sand and shale 7,048 ft.

HANKAMER—LIBERTY COUNTY

Gulf Prod. Co.'s No. 1 Crowe & Jacobs, H.&T.C. Sur., Sec. 21, 900 ft. from W line, 1,700 ft. from S line of N 320 ac. of section ..... Rigging up.

HULL—LIBERTY COUNTY

Aberoil Oil Co.'s No. 1 Barrow, Jesse Devore Sur., 64 ft. from N line, 760 ft. from E line of 10-ac. tract.. D.S. stuck 6,453 ft.

Houston Prod. Co.'s No. 2 Baldwin, Jesse Devore Sur., 50 ft. from S line, 50 ft. from E line of lease ..... Drlg. 4,400 ft.

Republic Prod. Co.'s No. 149 Dolbear, Jesse Devore Sur., 320 ft. W. of No. 6 ..... Pumping 35 bbls. net oil 1,546 ft.

Unique Oil Co.'s No. 1 Knox-Nelson-Layton, Jesse Devore Sur., 30 ft. from N line and midway E and W of ¼-ac. tract ..... Sand 4,934 ft; cmtd. csg.

CONROE—MONTGOMERY COUNTY

Alpha Oil Co.'s No. 1 T. S. Falvey, 466 ft. from S and E lines of G. Harris Sur. ..... T.D. 5,180 ft; flowing, estimated 15 bbls. per hr.; 7/16-in. choke.

Alpha Oil Co.'s No. 2 Keystone Mills, Lemuel Smith Sur., 1,492 ft. from S line, 466 ft. from W line of tract ..... Drlg. shale 5,010 ft.

Alpha Oil Co.'s No. 3-A Krohn, S. H. Bryan Sur., 791 ft. N of No. 2-A ..... T.D. 1,360 ft; trying to straighten hole.

Alpha Oil Co.'s No. 2-A South Tex. Dev. Co., T.&N.O. Sur. No. 13 ..... Rig.

Amerada Pet. Corp.'s No. 4 South Tex. Dev. Co., C. A. West Sur., 466 ft. from E line, 330 ft. from S line of lease ..... Drlg. shale 3,930 ft.

A. & P. Prod. Co.'s No. 1 Keystone Mills, A. Steele Sur., 466 ft. from S line of 40-ac. lease in center, E and W ..... Rigging up.

Bishop Oil Co.'s No. 1 South Tex. Dev. Co., T.&N.O. Sur. No. 5, 674 ft. from N line, 379 ft. from W line of 20-ac. tract ..... Drlg. shale 2,935 ft.

Feltex Oil Co.'s No. 2 Kirby-Bertrand, Wagers Sur., 1,267 ft. S of No. 1, in center of tract E and W .... Rig.

Giesecke & Craft's No. 1 Granger, T.&N.O. Sur. No. 14, 467 ft. out of NW cor. of 77-ac. lease ..... Derrick.

Heep Oil Corp.'s No. 1 E. A. Walker, C. T. Darby Sur., center of 12-ac. tract ..... Sand showing oil 5,171 ft.

Gulf Coast Drlg. & Prod. Co.'s No. 6 Keystone Mills, 466 ft. out of most westerly NW cor. of A. S. James Sur. ..... Shale and sand showing oil 4,-023 ft; cmtd. csg.

Gulf Coast Drlg. & Prod. Co.'s No. 7 Keystone Mills, 466 ft. from N and W lines of A. S. James Sur. .. Drlg. 2,360 ft.

Hamilton, Hill & Hill's No. 2 L. P. Gilbert, John Davis Sur., 333 ft. from W line of 34.7-ac. tract in center N and S ..... Comp. 25 bbls. per hr.; ¼-in. choke, 5,149 ft.

Harrison & Abercrombie's No. 2 Ben Wiggins, T. M. Wiggins Sur., 466 ft. from N line, 1,300 ft. from E line of lease ..... Drlg. shale 2,636 ft.

Harrison & Abercrombie's No. 3 Ben Wiggins, T. M. Wiggins Sur., 1,481 ft. from N line of survey, 250 ft. from E line of lease ..... Drlg. sandy shale 2,715 ft.

Harrison & Abercrombie's No. 1 W. S. Massey, 466 ft. from S and W lines of John Massey Sur. ..... Comp. 80 bbls. per hr.; ½-in. choke, 5,107 ft.

Houston Oil Co.-Tide Water Oil Co.'s No. 4 Cartwright, John Davis Sur., 333 ft. from E line, 700 ft. from N line of lease ..... Drlg. hard shale and lime 3,800 ft.

Houston Oil Co.-Tide Water Oil Co.'s No. 1 Moore, Lemuel Smith Sur., 356 ft. from the N line, 650 ft. from the E line of the 100-ac. lease ..... Coring sand 5,114 ft.

Houston Oil Co.-Tide Water Oil Co.'s No. 3 Moore, Lemuel Smith Sur., 350 ft. from N line, 466 ft. from W line of the 100-ac. lease ..... Derrick.

Humble O. & R. Co.'s No. 1 Alenius-Chisolm, W. C. Ry. Sur. No. 14, center of 20-ac. tract (Lots 52, 58, 60 and 61) ..... Cmtd. csg. 5,065 ft.

Humble O. & R. Co.'s No. 1-F Alexander, 333 ft. from E line, 586 ft. from S line of John McHorse Sur. ... Comp. 75 bbls. per hr.; ½-in. choke, 5,134 ft.

Humble O. & R. Co.'s No. 2-B Cartwright, John Davis Sur., 466 ft. out of SW cor. of "B" lease ..... Drlg. shale 4,625 ft.

Humble O. & R. Co.'s No. 11-A Cartwright, John Davis Sur., 466 ft. from N line, 2,448 ft. from W line of lease ..... Comp. 80 bbls. per hr.; ½-in. choke, 5,172 ft.

Humble O. & R. Co.'s No. 7 Dobbins, 452 ft. from N line, 1,514 ft. from W line of Ransom House Sur. .. Cmtd. csg. 5,050 ft.

Humble O. & R. Co.'s No. 4-B Hirsch, D. McIntyre Sur., 333 ft. S of No. 3 ..... Comp. 82 bbls. per hr.; ½-in. choke, 5,148 ft.

Humble O. & R. Co.'s No. 2 B. E. Jones (81 acres), 466 ft. from N line and 2,206 ft. from E line of Lemuel Smith ..... Coring sand 5,030 ft.

Humble O. & R. Co.'s No. 30 Madeley, Ransom House Sur., 1,709 ft. NW of No. 31 ..... T.D. 5,113 ft; cmtd. 7-in. csg.

Humble O. & R. Co.'s No. 32 Madeley, 453 ft. N of center of S line of Ransom House Sur. ..... Comp. 95 bbls. per hr.; 5,142 ft.

Humble O. & R. Co.'s No. 3 L. B. McComb, Lemuel Smith Sur., 1,329 ft. from E line, 466 ft. from S line.. Comp. 110 bbls. per hr.; ½-in. choke, 5,139 ft.

Humble O. & R. Co.'s No. 26 Moore, Lemuel Smith Sur.. Cmtd. csg. 5,040 ft.

Humble O. & R. Co.'s No. 2 Ezra Moorehead, 466 ft. E and 466 ft. S from most southerly NW cor. of L. A. Lang Sur. ..... T.D. 2,961 ft; pumping wtr. into hole.

Humble O. & R. Co.'s No. 3 Plaefflin, 880 ft. from N line, 664 ft. from W line of W. M. Real Sur. ..... Comp. 106 bbls. per hr., 5,168 ft.

Humble O. & R. Co.'s No. 4 Plaefflin, 658 ft. S of No. 3, W. M. Real Sur. ..... Drlg. sand and shale 377 ft.

Humble O. & R. Co.'s No. 43 South Tex. Dev. Co., 1,-200 ft. from S line, 4,600 ft. from E line of Theo. Slade Sur. ..... Cmtd. csg. 5,055 ft.

Humble O. & R. Co.'s No. 44 South Tex. Dev. Co., 664 ft. W of center of E line of Theo. Slade Sur. ..... Comp. 95 bbls. per hr., 5,164 ft.

Humble O. & R. Co.'s No. 1 R. Wiggins, T. M. Wiggins Sur., center of tract ..... Drlg. shale 4,809 ft.

Humble O. & R. Co.'s No. 1 J. C. Young, Wilson Strickland Sur. ..... Cmtd. csg. 5,010 ft.

W. M. Massey's No. 2 Fannie Hooper, 1,030 ft. from N line, 635 ft. from W line of Fannie Hooper (De-Moss) Sur. ..... Cmtd. 10-in. csg. 1,290 ft.

McAlbert Oil Co.'s No. 2 Keystone Mills, 433 ft. from S line, 434 ft. from W line of A. Steele Sur. ..... Rig.

Navarro Oil Co.'s No. 1 Brown, 466 ft. out of NW cor. of E. P. Brown Sur. ..... Comp. 90 bbls. per hr., 5,127 ft.

Navarro Oil Co.'s No. 1 Myers, C. A. West Sur. ..... Cmtd. 10-in. csg. 1,250 ft.

Neuhaus & Horn's No. 1 South Tex. Dev. Co., center of L. L. Horn 16.31-ac. tract in T.&N.O. Sur. No. 5 Drlg. 4,350 ft.

Neversuch Oil Co.'s No. 2 South Tex. Dev. Co., T.&N.O. Sur. No. 5, 933 ft. N of No. 1, in center of tract E and W ..... Comp. 48 bbls. per hr.; ¼-in. choke, 5,133 ft.

Neversuch Oil Co.'s No. 3 South Tex. Dev. Co., T.&N. O. Sur. No. 5, 933 ft. N of No. 2 in center of lease N and S ..... Cmtd. 10-in. csg. 1,318 ft.

Republic Prod. Co.'s No. 1 B. D. Griffin, Wilson Strickland Sur., 233 ft. from E line, 466 ft. from N line of lease ..... Drlg. 1,625 ft.

Showers & Moncrief's No. 3 Dunn, Wilson Strickland Sur., 900 ft. S of No. 1 ..... Drlg. shale 4,255 ft.

Southern Liberty Oil Co.'s No. 1 South Tex. Dev. Co., T.&N.O. Sur. No. 5, 350 ft. out of NW cor. of 18.675-ac. tract ..... Cmtd. 10-in. csg. 1,339 ft.

Standard Oil Co. of Kans.' No. 2-A Madeley, Ransom House Sur., 1,374 ft. from N line, 695 ft. from E line of survey ..... Drlg. shale 890 ft.

Standard Oil Co. of Kans.' No. 3 Smith & Ratcliff, W. S. Rhodes Sur., 466 ft. from N and W lines of lease.. Cmtd. csg. 5,105 ft.

Steinberger, Brown & Wheeler's No. 2 South Tex. Dev. Co., T.&N.O. Sur. No. 5, 450 ft. from S line in center E and W of 20-ac. tract in 40-ac. lease ..... Comp. 35 bbls. per hr., 5,120 ft.

Steinberger, Brown & Wheeler's No. 3 South Tex. Dev. Co., T.&N.O. Sur. No. 5, center of NE 10 acres of 50-ac. tract ..... T.D. 5,120 ft; cmtd. 7-in. csg., 5,-014 ft.

Strake Pet., Inc.'s No. 1 K. G. Shaffer, C. R. Stewart Sur., 555 ft. from E line, 1,400 ft. from S line of lease ..... Drlg. shale 3,165 ft.

Sun Oil Co.'s No. 1 Jones, Sitton Sur., 466 ft. out of NW cor. of tract ..... Drlg. gumbo 1,490 ft.

Sun Oil Co.'s No. 2 Foster, John Bricker Sur., 933 ft. SW of No. 1 ..... Rigging up.

Sun Oil Co.'s No. 1 South Tex. Dev. Co., T.&N.O. Sur., No. 5, 467 ft. from S line in center E and W of 40-ac. tract ..... Drlg. shale and lime 4,902 ft.

Sun Oil Co.'s No. 2 South Tex. Dev. Co., T.&N.O. Sur. No. 5, 943 ft. N of No. 1 in center of lease E and W Drlg. shale 4,920 ft.

Sun Oil Co.'s No. 2 Jones, Wilson Strickland Sur., 466 ft. from N and E lines of lease ..... Drlg. shale 820 ft.

Sun Oil Co.'s No. 2 Stewart, J. M. Real Sur., 1,250 ft. from E line, 1,460 ft. from S line of lease ..... Cmtd. 10¾-in. csg. 1,360 ft.

Sun Oil Co.'s No. 3 Stewart, J. M. Real Sur., 1,040 ft. from E line, 700 ft. from N line of lease ..... Drlg. shale 3,650 ft.

The Texas Co.'s No. 2 Dudley, C. B. Stewart Sur., 466 ft. from S and E lines of lease ..... Comp. 75 bbls. per hr., 5,100 ft.

The Texas Co.'s No. 10 Moody, 3,030 ft. from E line, 600 ft. from S line of Ransom House Sur. ..... Comp. 95 bbls. per hr., 5,118 ft.

The Texas Co.'s No. 15 Moody, Ransom House Sur., 966 ft. N of No. 14 ..... Cmtd. 10¾-in. csg. 1,298 ft.

The Texas Co.'s No. 17 Moody, Ransom House Sur., 320 ft. NW of No. 16 ..... Cmtd. 7-in. csg. 5,042 ft.

The Texas Co.'s No. 20 Moody, 2,300 ft. E along S line of Wilson Strickland Subd. from SW cor. and 466 ft. S at right angles ..... Rig.

The Texas Co.'s No. 2 Rhodes, 979 ft. 15 deg. W, 466 ft. N 75 deg. E of SW cor. of W. S. Rhodes Sur. .... Comp. 94 bbls. per hr., 5,120 ft.

The Texas Co.'s No. 4 W. S. Rhodes, 466 ft. S of SW cor. of C. T. Darby Sur., and 350 ft. at right angles to W. S. Rhodes Sur. ..... Comp. 73 bbls. per hr., 5,114 ft.

The Texas Co.'s No. 7 Rhodes, 1,310 ft. from E line of lease and 330 ft. S of S line of C. A. West Sur. to W. S. Rhodes Sur. ..... Drlg. hard shale 1,287 ft.

The Texas Co.'s No. 12 Rhodes, W. S. Rhodes Sur., 1,336 ft. from W line, 600 ft. from S line ..... Coring shale 4,711 ft.

The Texas Co.'s No. 13 Rhodes, 1,450 ft. from S line, 1,300 ft. from E line of lease, W. S. Rhodes Sur. ... Derrick.

The Texas Co.'s No. 14 Rhodes, W. S. Rhodes Sur., 1,060 ft. from W line, 1,470 ft. from S line ..... Drlg. sticky shale 3,044 ft.

Tide Water Oil Co.-Strake's No. 4 Dean, W. C. C. Lynch Sur., 467 ft. from S and E lines of lease .... Drlg. shale and shells 3,205 ft.

Tide Water Oil Co.'s No. 5 Dean, W. C. C. Lynch Sur., 1,363 ft. from E line, 467 ft. from S line of lease....Drlg. gumbo and lime 2,310 ft.
Tide Water Oil Co.'s No. 1 J. R. Eichlets, Lemuel Smith Sur., 2,147 ft. from E line and 225 ft. from S line of 160-ac. tract ..... Drlg. gumbo 4,115 ft.
Tide Water Oil Co.'s No. 3 Eichlets, Lemuel Smith Sur., 467 ft. from N line, 1,010 ft. from E line of lease ..... Derrick.
Tide Water Oil Co.'s No. 1 Granger, 467 ft. from N and W lines, T.&N.O. Sur. No. 14 ..... Comp. 42 bbls. per hr.; ½-in. choke, 5,074 ft.
Tide Water Oil Co.'s No. 14 Lewis, C. B. Stewart Sur., 2,282 ft. from N line and 467 ft. from E line of lease. Comp. 110 bbls. per hr., 5,090 ft.
Tide Water Oil Co.'s No. 16 Lewis, C. B. Stewart Sur., 467 ft. from S and W lines of lease ..... Comp. 94 bbls. per hr., 5,121 ft.
Tide Water Oil Co.'s No. 17 Lewis, C. B. Stewart Sur., 1,570 ft. from W line, 467 ft. from S line of lease.. Sand 5,049 ft; cmtd. 7-in. csg. 5,027 ft.
Tide Water Oil Co.'s No. 18 Lewis, C. B. Stewart Sur., 396 ft. from S line, 1,162 ft. from E line of tract ... Drlg. shale 2,166 ft.
Tide Water Oil Co.'s No. 19 Lewis, C. B. Stewart Sur., 395 ft. from S line, 2,130 ft. from E line of lease .... Cmtd. 10¾-in. csg. 937 ft.
Tide Water Oil Co.'s No. 20 Lewis, 1,493 ft. from S line, 467 ft. from E line of lease ..... Cmtd. 10¾-in. csg. 912 ft.
Tide Water Oil Co.-Republic Prod. Co.'s No. 6 South Tex. Dev. Co., T.&N.O. Sur. No. 5, 2,379 ft. from S line, 330 ft. from E line ..... Drlg. shale 4,410 ft.
Tide Water Oil Co.'s No. 7 South Tex. Dev. Co., T.&N. O. Sur. No. 5, 2,175 ft. from S line, 330 ft. from E line ..... Drlg. shale 3,447 ft.

PORT NECHES—ORANGE COUNTY

The Texas Co.'s No. 3 Kuhn (W.O.), Mary E. Hall Sur., No. 2, 587 ft. S, 150 ft. W of NE cor. of survey..... T.D. 4,118 ft; pulling screen to deepen.

CLAY CREEK—WASHINGTON COUNTY

Sun Oil Co.'s No. 6 Clay, J. F. Perry Sur., 300 ft. N of No. 5 ..... Abd. in cap rock 2,114 ft.

SOUTH LOUISIANA FIELDS

DARROW—ASCENSION PARISH

Rio Bravo Oil Co.'s No. 2 Community, Sec. 31-10s-2e, 1,760 ft. S, 600 ft. W of No. 1 ..... Coring hard sand 4,798 ft.
Rio Bravo Oil Co.'s No. 1 Gumbel, 4,000 ft. W, 250 ft. S of NE cor. of S. Gumbel & Co. tract, Sec. 33-10s-2e.. Coring hard sand 5,536 ft.

SORRENTO—ASCENSION PARISH

Union Sulphur Co.'s No. 24 United Land Co., Sec. 14-10s-4e, 2,500 ft. E of No. 6 ..... Bldg. derrick.

IOWA—CALCASIEU AND JEFF DAVIS PARISHES

Magnolia Pet. Co.'s No. 3 Waite, 330 ft. out of NE cor. SE Sec. 13-9s-7w ..... Drlg. brittle shale 6,942 ft.
Shell Pet. Corp.'s No. 2 Heyd, 265 ft. N, 330 ft. W of SE cor. NE Sec. 13-9s-7w ..... Sand showing oil 5,539 ft; cmtd. 9⅝-in. csg.
Shell Pet. Corp.'s No. 1 Stafford, 325 ft. S, 325 ft. E of NW cor. Sec. 16-9s-6w ..... Drlg. shale and lime 6,490 ft.

LOCKPORT—CALCASIEU PARISH

Magnolia Pet. Co.'s No. 23 Miller, Sec. 9-10s-9w, 200 ft. S and 685 ft. E of NW cor. of lease ..... Sand 3,848-53 ft; comp. 200 bbls., ⅝-in. choke, 200 lbs.

STARKS—CALCASIEU PARISH

Union Sulphur Co.'s No. 1 Lutcher-Moore, 2,200 ft. W, 1,010 ft. N of SE cor. Sec. 10-9s-12w ..... Salt 2,015-2,348 ft.

SULPHUR—CALCASIEU PARISH

Union Sulphur Co.'s No. 771 fee (D.D.), 431 ft. S and 340 ft. W of center of Sec. 29-9s-10w ..... Comp. pumping 15 bbls. net oil, 5,158 ft.
Union Sulphur Co.'s No. 777 fee, 753 ft. E and 756 ft. N of center Sec. 29-9s-10w ..... Drlg. shale and lime 3,890 ft.
Union Sulphur Co.'s No. 778 fee, 342 ft. N, 1,755 ft. W of center Sec. 29-9s-10w ..... Drlg. lime 4,020 ft.

GUEYDAN—VERMILLION PARISH

Pure Oil Co.'s No. 3 Mulvey, Sec. 34-11s-1w, 1,515 ft. from N line, 1,150 ft. from E line of tract ..... Drlg. brittle shale and shell 4,811 ft.
Pure Oil Co.'s No. 3 Mulvey, 600 ft. S, 2,369 ft. E of NW cor. Sec. 34-11s-1w ..... Drlg. hard lime 3,312 ft.

HACKBERRY—CAMERON PARISH

Calcasieu Oil Co.'s No. 1 Hanszen, 300 ft. W and 30 ft. N of SE cor. SW SE Sec. 11-12s-10w ..... Sand 5,965 ft; cmtd. csg.
Massert & Cruse's No. 1 J. B. Duhon, 656 ft. S, 325 ft. E of NW cor. Sec. 26-12s-10w ..... Coring sand and shale 3,760 ft.
The Texas Co.'s No. 10-B State, 1,000 ft. E, 300 ft. N of NE cor. Sec. 15-12s-10w ..... Shale 6,190 ft.
Union Sulphur Co.'s No. 5 Gulf Land-Humble lease, Sec. 11-12s-10w, 300 ft. N of No. 1 ..... Drlg. gumbo 3,810 ft.
Yount Lee Oil Co.'s No. 12 School land, Sec. 16-12s-10w, 100 ft. N, 100 ft. W of No. 10 ..... Drlg. 3,700 ft.

CHOCTAW—IBERVILLE PARISH

Standard Oil Co.'s No. 3 Gay, 520 ft. S, 300 ft. E of center Sec. 52-9s-11e ..... Drlg. 5,100 ft.
Standard Oil Co.'s No. 4 Myrtle Grove, 2,350 ft. S, 150 ft. W of NE cor. NW Sec. 52-9s-11e ..... Driving piling for derrick.

CAMERON MEADOWS—CAMERON PARISH

Magnolia Pet. Co.'s No. 3 Cameron Meadows, 2,620 ft. S, 1,900 ft. W of NE cor. Sec. 21-14s-13w..... Coring salt 6,437 ft; top of salt 6,179 ft.

SWEET LAKE—CAMERON PARISH

Pure Oil Co.'s No. 11 Yount Lee, Sec. 12-13s-8w, 800 ft. S 66 deg. 42 min. from No. 9 ..... T.D. 6,920 ft; reaming to straighten hole.

TEXAS

MISCELLANEOUS WILDCATS

AUSTIN COUNTY

Cranfill-Reynolds Co.'s No. 1 J. B. Lewis, 3,150 ft. from N line, 330 ft. from W line of J. C. Hacienda Sur... Drlg. shale 3,652 ft.

BRAZORIA COUNTY

Amerada Pet. Corp. and Rycade Oil Corp.'s No. 3 Seaburn, 1,250 ft. E of W line and 4,550 ft. S of N line of Austin & Williams Sur. ..... Drlg. hard lime 3,637 ft.
Currie Oil Co.'s No. 2 Tolar & Dannenbaum, Williams & Austin Sur., 1,600 ft. SW of Freeport Sulphur Co.'s No. 8 ..... Drlg. shale 900 ft.
Danciger O. & R. Co.'s No. 2 Hunt, Pledger, 5,550 ft. from E line, 5,550 ft. from S line of W. Carson Sur.. Spudded.
Tri-fin Oil Co.'s No. 1 Moers, 1,635 ft. SW of Chocolate Bayou, 693 ft. SE of NW line of F. Moore Sur. ..... Drlg. sand 4,423 ft.

BRAZOS COUNTY

Adkins & O'Neill's No. 1 Clay, 1,150 ft. E, 5,750 ft. N of SW cor. of Walter Southerland Sur. ..... Drlg. brown shale 3,263 ft.

COLORADO COUNTY

Danciger O. & G. Co. and L. E. Huitt' No. 1 C. L. Raver, B.B.B.&C. Sur., Sec. 1, 990 ft. out of SW cor. of 477-ac. tract ..... Drlg. clay 776 ft.
Humble O. & R. Co.'s No. 1 John McShane, L.&G.N. Sur., Sec. 42, 466 ft. out of NE cor of tract ..... Coring sand 4,392 ft.
Plymouth Oil Co.'s No. 1 Ream, 330 ft. out of NE cor. of L.&G.N. Sur. No. 47 ..... Drlg. shale 2,227 ft.

FORT BEND COUNTY

Naylor & DeCosta's No. 1 Naylor, 6,850 ft. N, 55 deg. E from SW cor. 653-ac. tract in Christman Sur. .... T.D. 7,014 ft; preparing to resume operations.

HARRIS COUNTY

D.P.M. Corp.'s No. 1 Malcomson, A. Schouten Sur., 500 ft. from N line, 1,800 ft. from E line of 283-acre Daniels tract ..... Derrick.
H. B. Jordan's No. 1 Cochran, J. L. Jordan Sur., 1,950 ft. from S line, 1,930 ft. from E line ..... Rebuilding derrick.
Magnolia Pet. Co.'s No. 1 Kobs, 933 ft. from E line, 1,650 ft. from N line of lower J. M. Hooper Sur. .... Bldg. derrick.
Magnolia Pet. Co.'s No. 1 Martens, Joseph House Sur., 600 ft. from W line, 5,600 ft. from S line of tract .. Rigging up.
Weatherall Prod. Co.'s No. 1 Paden, 1,320 ft. from N line, 1,320 ft. from W line of Brock Sur. ..... Derrick.

JACKSON COUNTY

Chicago Gulf Oil Corp.'s No. 10 Drushell (W.O.), Hayes Sur. (Edna) ..... T.D. 6,224 ft; plugged to 5,400 ft., comp. gas well.
The Texas Co.'s No. 1 Mitchell, S. F. Austin League, 450 ft. W, 450 ft. S of NE cor. of 63-ac. tract, Lot 38, Clement Subd. ..... Derrick.

JASPER COUNTY

Smithermen, Neilson & Noble's No. 1 Cameron, Wm. Jones Sur., 400 ft. S 45 deg. W of SW cor. of J. W. Allen 300-ac. tract ..... Shale 3,410 ft; preparing to resume operations.

JEFFERSON COUNTY

Carroll & Miller's No. 1 C. A. Mashman, W. B. Dyches Sur., 462 ft. W of highway and 106 ft. S of NE line of 13-ac. tract ..... Drlg. gumbo 905 ft.
Coastal Oil Co.'s No. 1 Young, 230 ft. from E line, 160 ft. from S line of 40-ac. tract, in Blk. F-5, Lot 4, Joseph Grigsby Sur. ..... S.D. 4,500 ft.
Elam & Denny's No. 2 Broussard, John McGaffey Sur., 150 ft. due E of No. 1 ..... Drlg. shale 3,112 ft.

LIBERTY COUNTY

Yount Lee Oil Co.'s No. 1 E. W. Boyt, H.&T.C. Sur., Sec. 17, 300 ft. from S line, 2,440 ft. from E line of section ..... Rigging up.

MATAGORDA COUNTY

Cockburn Oil Corp.'s No. 5 Hawkins, Shepherds Mott, 2,200 ft. SE, 1,800 ft. NE of W cor. Daniel McCarthy Sur. ..... T.D. 5,320 ft; plugged to 3,150 ft; trying to mill out 3,100 ft.
Humble O. & R. Co.'s No. 2 Pierce est., 1,900 ft. NE, 466 ft. NW at right angles out of SW cor. of Pierce estate, same being NW cor. of W. S. and L. B. Hunt tract, W. Carson Sur. ..... Rigging up.
United North & South Dev. Co.'s No. 1 Stoddard (W.O.), 150 ft. W, 545 ft. N of SE cor. of Blk. 53, Buckeye townsite ..... T.D. 7,926 ft; P.B. to sidetrack.
United North & South Dev. Co.'s No. 1 Unit 6 (No. 2 Stoddard), 25 ft. each way out of NW cor. of Lot 19, Buckeye Townsite ..... Shale 5,609 ft; setting 9⅝-in. csg.
United North & South Dev. Co.'s No. 1 Unit 14 (No. 1 Dr. Plotner), 1,210 ft. SE of No. 1 Stoddard and 136 ft. W of right of way of Collegeport branch of St. L.&B.M.R.R., Buckeye ..... Gumbo 1,410 ft.; cmtd. 13⅜-in. csg.

MONTGOMERY COUNTY

A. H. Parsons et al's No. 2 Drought, Kronknite Sur., 2,000 ft. N, 100 ft. E of NW cor. of A. B. Hill 46¼ acres ..... Drlg. shale 3,951 ft.
C. C. Steinberger's No. 1 F. B. Smith, R. Rogers Sur., 466 ft. from S and E lines of S 150 acres of 214.8-ac. tract ..... Coring shale 4,779 ft.

POLK COUNTY

Anderson et al's No. 1 Duke, Peter J. Manard Sur., 320 ft. out of NW cor. of 235-ac. tract ..... Washing to bottom 4,735 ft.
Boone, Clark & Boone's No. 1 Tex. Long Leaf, 2,335 ft. NW along NE line of D. B. McComb Sur. from E cor. and 1,188 ft. SW at right angles ..... Derrick.
Carlisle & Williams' No. 1 G. McDonald, A. Viesca Sur., Sec. 5, 150 ft. N, 230 ft. E of 110-ac. tract ..... Drlg. gumbo 1,862 ft.
Roxie Oil Co.'s No. 1 Reed, A. Viesca Sur., 150 ft. out of NW cor. of 479-ac. lease ..... Rig.
Shell Pet. Corp.'s No. 1 Davis & Holmes, 320 ft. S and E out of NE cor. of J. A. Munson 80-ac. tract in Mary Sweeney (A. Viesca) Sur. ..... Drlg. sticky shale 3,228 ft.

REFUGIO COUNTY

Geo. M. Smith's No. 1 J. M. O'Brien, 450 ft. W of center of E line of Winfield Sur. ..... Drlg. sand and shale 2,205 ft.
Humble O. & R. Co.'s No. 4 O'Connor, Florentine Rice Sur., 933 ft. NW of No. 3 ..... Derrick.

TRINITY COUNTY

L. G. Priest's No. 1 J. B. Gibson, Wm. Beardsley Sur., 900 ft. from N line, 200 ft. from E line of tract .... S.D. 900 ft.

TYLER COUNTY

Republic Prod. Co. and Houston Oil Co.'s No. 1 Sam Jeffcoat, E. Thompson Sur., 467 ft. N and E from SW cor. of 160-ac. tract ..... Abd. location.
Republic Prod. Co. and Houston Oil Co.'s No. 1016-E Kirby, E. Thompson Sur., 467 ft. out of SE cor. of 128-ac. tract ..... Drlg. sandy shale 5,206 ft.

VICTORIA COUNTY

Gulf Prod. Co.'s No. 3 Keeran Ranch, Martin DeLeon Sur., 1,320 ft. NW of No. 1 ..... T.D. 7,465 ft; plugged to sand 5,698-5,702 ft.
The Texas Co.'s No. 6 McFaddin, 5,600 ft. S 15 deg. W and 450 ft. N 75 deg. W from E or NE cor. of Andrew J. Gary Sur. ..... T.D. 3,047 ft; blowing wild; rigging up to cap well.
The Texas Co.'s No. 7 McFaddin, 6,600 ft. S 15 deg. W, 450 ft. N 75 deg. W at right angles from the NE cor. of the A. J. Gray Sur. ..... Derrick.
Quintana Oil Co.'s No. 1 McCormic, 600 ft. from SW line, 600 ft. from NW line of S.A.&M.G. Sur., Sec. 3, in most westerly NW cor. ..... Coring shale 7,203 ft.

WASHINGTON COUNTY

Cline, Taylor et al's No. 1 Chadwick, Isaac Lee Sur., 560 ft. from N line, 1,000 ft. from E line of 320-ac. tract ..... Derrick.

WHARTON COUNTY

Pure Oil Co.'s No. 1 Stewart, 2,419 ft. NW, 1,650 ft. NE of S cor. of Sec. 25, Morris & Cummings Sur. ..... Drlg. hard sandy shale 5,272 ft.
Smith & Daniels' No. 1 Mitchell, H.&T.C. Sur. No. 5, 330 ft. from NE line of NE 80-ac. tract in center of tract NW and SE ..... T.D. 6,875 ft; twisted off 6,330 ft. of drill pipe.

SOUTH LOUISIANA

CAMERON PARISH

Southern Sulphur Co.'s No. 1 Gulf of Mexico, 330 ft. S, 338 ft. E of SW cor. Sec. 29-15s-10w ..... Building derrick.

JEFFERSON DAVIS PARISH

Humble O. & R. Co.'s No. 2 Devilbiss, 1,850 ft. S, 250 ft. W of NE cor. Sec. 14-9s-4w ..... Rigging up.

LA FOURCHE PARISH

Southern Sulphur Co.'s No. 1 State-Bay Marchand, 617 ft. E, 710 ft. S of SW cor. Sec. 20, in Sec. 29-23s-23e. Derrick.

PLAQUEMINES PARISH

Texas Gulf Sulphur Co.'s No. 1 LaFourche Levee district, 595 ft. from N line, 75 ft. from W line of Sec. 12-18s-25e ..... Rigging.

ST. BERNARD PARISH

Cook Drlg. Co.'s No. 1 Delacroix farm ..... Drlg. shale 5,900 ft.
Southern Sulphur Co.'s No. 1 State-Lake Borgne, 350 ft. N, 330 ft. E of SE cor. Sec. 32-13s-15e ..... Rig.
Southern Sulphur Co.'s No. 1 Lake Levy, 400 ft. S, 500 ft. N of SW cor. Sec. 28-13s-15e ..... Derrick.

TERREBONNE PARISH

The Texas Co.'s No. 2 State-Caillou Island, 1,050 ft. S, 2,770 ft. E of NW cor. Sec. 20-23s-20e ..... Driving piling.
The Texas Co.'s No. 5 State-Dog Lake, 4,067 ft. W, 1,877 ft. N of SE cor. Sec. 31-21s-16e ..... Preparing to build derrick.
The Texas Co.'s No. 3 Lake Pelto-State, 925 ft. S and 625 ft. E of NW cor. of Sec. 9-22s-18e ..... Drlg. anhydrite 3,650 ft.

VERMILLION PARISH

Shell Pet. Corp.'s No. 1 Herbert, 2,310 ft. W, 330 ft. N of SE cor. Sec. 10-15s-1e ..... Coring brittle shale 5,893 ft.

Wildcat Operations in Southwest Texas

(Continued from Page 104)

Rollin V. Hill, Sr.'s No. 1 Max Boseck, 1,700 ft. from N line, 2,700 ft. from E line of tract in J. R. Shephard Sur. ..... T.D. 498 ft.; standing.

M. L. Howard's (Allen Park) No. 1 James Watson, 15 miles S from San Antonio ..... T.D. 3,535 ft.; taken over from Allen Park; plugging back 10 ft

O. L. Ray's No. 1 Thos. Dillon, 3,500 feet from NW line, 1,750 ft. from most southerly SW line of de Luna grant in southern part of county ..... T.D. 450 ft; changing to rotary.

J. Morgan Russell's No. 1 Brotse, 790 ft. from W line, 300 ft. from N line of 50-ac. tract in Cordenas Sur... Spudded in.

Earl E. Post's No. 1 Bilharts, 1,365 ft. from W line, 2,160 ft. from S line of 285-ac. tract in F. Rolen Sur., No. 45 ..... T.D. 135 ft; drlg.

Sun Rise Oil Co.'s No. 1 R. J. Uecker, 150 ft. from N line, 450 ft. from W line J. M. Perez Sur. ..... T.D. 600 ft.; drlg.

Swearingen Oil Co.'s No. 1 W. H. Russell ..... T.D. 750 ft; drlg.

CALDWELL COUNTY

Fred Adams' of Lockhart No. 1 Robertson, 450 ft. from N and W lines of Robertson 100-ac. tract in John Neill Sur. ..... T.D. 2,222 ft.; csg. collapsed.

DUVAL COUNTY

Commonwealth O. & G. Co.'s No. 1 J. Benavides, 330 ft. from SW and SE lines of Sec. 1, Carpenters Subd. of El Mesquite Grant Sur. ..... T.D. 3,160 ft.; abnd.

Ed Leach et al's No. 1 C. J. Bain, 330 ft. to S line, 330 ft. to E line of NW SW of Sur. 264 ..... T.D. 1,100 ft; S.D.

Newton et al's No. 1 Welder-Wood, 5,550 ft. from W line, 4,590 ft. from N line of Sur. 102 ..... T.D. 1,927 ft.; drlg.

C. P. Scott's No. 1 J. W. Kidd, 990 ft. from N and E lines of SE of Sur. No. 56 ..... T.D. 2,268 ft.; drlg. deeper.

Wm. B. Stewart's No. 1 Duval County Ranch Co., 990 ft. to S and E lines, of NE of Sur. 362..... T.D. 2,296 ft.; setting csg.

Wm. B. Stewart's No. 2 Duval County Ranch Co., 330 ft. from N and W lines of N½ SW of Sur. 362... T.D. 1,576 ft; set csg.

Shasta Oil Co.'s No. 1-B Peters, 990 ft. from W line, 330 ft. from N line of NW SW Sur. No. 176..... T.D. 2,707 ft.; set csg.; waiting on cmt.

FRIO COUNTY

James E. Greenlee's No. 1 W. W. Burns, 613 vrs. to N line, 990 vrs. to W line of Antone Hutzler Sur. ..... T.D. 2,330 ft.; in shale; waiting for csg.

HIDALGO COUNTY

Carl & Johnston's No. 1 Doughty, 187 ft. from S and E lines of Lot 11, Blk. 8 of Subd. of Indios Ranch Sur., in N. Hidalgo ..... T.D. 1,475 ft; set csg.

Nat G. Martin's No. 1 Garcia Land & Cattle Co., 150 ft. N of cen. of Military Highway, 155 ft. from W line of Porcion No. 42, jurisdiction Reynosa ..... Spudded in for 4,000-ft. test.

JIM WELLS COUNTY

Magnolia Pet. Co.'s No. 2 A. A. Scelligson, 3,000 ft. from E line, 180 ft. from S line of V. Canales Sur. No. 218 ..... T.D. 3,253 ft.; sprayed oil, recemented csg.

JIM HOGG COUNTY

Cole Pet. Co.'s No. 1 E. Vela Hrs., 5,184 ft. from E line, 2,762 ft. from S line of Sur. 588 in El Peyote grant ..... T.D. 750 ft; drlg.

Miam Drlg. Co.'s No. 1 E. L. Armstrong, 330 ft. from N and W lines of Sur. No. 99 ..... T.D. 2,510 ft.; abnd.

KARNES COUNTY

W. R. Campbell's No. 1 E. C. Gillett, 2,594 ft. from SE line, 810 ft. from SW line of 391.5-ac. tract in C. Martinez Sur. ..... T.D. 1,740 ft; drlg.

KERR COUNTY

J. R. Anderson's No. 1 J. D. Witt, 1,320 ft. from N line, 1,320 ft. from W line of Sec. 1,923, in Hamilton Sur., 4 miles S of Center Point ..... T.D. 350 ft; drlg.

LIVE OAK COUNTY

Duval Oil Corp.'s No. 1 Border National Bank, 5 miles E of Jacob Pool ..... T.D. 860 ft.; testing.

J. A. Harper's No. 2 fee, center of Blk. 40 ..... T.D. 1,360 ft.; abnd.

Humble O. & R. Co.'s No. 1 Albert West, 4,000 ft. S of river, 150 ft. from NW line of tract in Thos. Hammond Sur. ..... T.D. 3,639 ft.; abnd.

Jacob, Buzzini & Pickett's No. 1 O. M. Withers, 920 ft. to N line, 370 ft. to W line of Farm 10, McCowan ranch ..... Set surface csg.

Homer T. Lamb's No. 1 J. T. Brown, 150 ft. from N line, 2,450 ft. from W line of 692-ac. tract in M. Holy Sur. ..... T.D. 1,204 ft; in sand; to make D.S. test.

LEE COUNTY

Paton Bros.' No. 1-B Turner, 424 ft. from NW line, 375 ft. from NE line of 51.9-ac. tract in David Hudson Sur. ..... T.D. 3,175 ft; drlg. 2,875 ft. in sidetracked hole.

Sayre Oil Co.'s No. 1 Rister, 150 ft. from S and E lines of N 100-ac. Rister tract in J. V. Jamison Sur... T.D. 2,640 ft.

McMULLEN COUNTY

Jaqua & Crow's No. 1 Hagist, 330 ft. from N and W lines of R. W. Mills Sur. No. 467 ..... T.D. 2,232 ft.; standing.

Greenwood & Calvert's No. 1 G. A. Booth, 3,300 ft. from NW line, 7,000 ft. from SW line of 4 miles SW from Calliham ..... T.D. 1,257 ft; S.D. for repairs.

C. R. Pope, Inc.'s No. 1 A. C. Miles, 200 ft. to E line, 2,375 ft. to S line, Sur. 149 ..... Rigging up.

C. C. Shumway's No. 2 Shiner, half mile SW of No. 1.. T.D. 200 ft.; drlg.

S. R. C. Oil Co.'s No. 1 La Chusa, 1,320 ft. to S and E lines of Sur. 47 ..... T.D. 2,134 ft.; drlg.

Tarver & Nance Co.'s No. 3 Dickson Farm Mrtg. Co., 700 ft. due W of No. 1, 900 ft. from NE line, 300 ft. from SE line of survey, Sec. 45 ..... T.D. 632 ft.; changing rigs.

MEDINA COUNTY

W. L. Umbarn's No. 1 Mangold, 200 ft. from E line, 150 ft. from S line of Leam Palmer Sur. ..... T.D. 1,005 ft.; abnd.

NUECES COUNTY

John F. Camp's No. 1 King, 150 ft. from N and W lines of B½ Sec. 29 of Richard King Subd. Sur. Bldg. derrick.

STARR COUNTY

R.A.B. Oil Co.'s No. 1 Crown Brick & Tile Co., 1,500 ft. S of State Highway No. 4 and 530 ft. from W line of Porcion 87, near La Puerta ..... T.D. 4,530 ft; waiting for csg.

Chiquita Oil Co.'s No. 1 Starr County Cattle Co., 341 ft. from W line, 271 ft. from S line of Share 60, Partition of Porciones 83 and 89 ..... Rigging up.

F. B. Cooper's No. 1 J. M. Martinez, 150 ft. to S and E lines of A.B.&M. Sur. No. 135 ..... T.D. 1,663 ft.; drlg.

Four-In-One Oil Synd.'s (J. B. Waldron) No. 1 Marks Estate, 300 ft. SW of center of Sur. No. 488 (in Blk. 19) ..... Spudded in.

Goodwin & Yantis' No. 1 Walker, 450 ft. SE of W line of Isabel Lopez property in Sur. 767 ..... T.D. 1,000 ft; moving in rotary.

R. McCormick's No. 1 I. G. Garcia, 1,250 ft. from N line, 425 ft. from E line of Blk. 11-B, Subd. of Porc. 71-72 ..... T.D. 580 ft.; abnd.

UVALDE COUNTY

J. V. Scoggin's No. 1 Olive Henry, 1,100 ft. from N and E lines of tract in Hugh Kilgore Sur. ..... T.D. 715 ft; drlg.

WEBB COUNTY

Earl Calloway et al's (Osborne) No. 1 Gates, 330 ft. from N and W lines, SE Sec. 14, Blk. 1 (Gates ranch), C.C.S.D.&R.G.N.G.R.R. Sur. ..... T.D. 435 ft.; drlg.

Cole Pet. Co.'s No. 1 A. Villareal, 350 ft. from S and W lines of Sur. No. 1,996, 5 miles E of Oilton ..... T.D. 1,950 ft.

Seagraves & Salsbury's No. 1 A. E. Gates, 2,850 ft. from S line, 725 ft. from W line of Sec. 66, Blk. 1, C.C.S.D.&R.G.N.G. Sur. ..... T.D. 450 ft.; drlg.

WILSON COUNTY

Sexton Pet. Co.'s No. 1 Joe Gutzeit (1,032-ac.), 150 ft. from W line, 150 ft. from S line of road of F. Flores No. 15 Sur. ..... T.D. 175 ft; drlg.

ZAPATA COUNTY

Hamilton, Brower & Crow's No. 1 Slator, 2,111 ft. from SW line, 1,980 ft. from SE line of Blk. 1, Subd. of Slator ranch in J. V. Borrego grant ..... T.D. 1,240 ft.; standing.

O. W. Killam's No. 2 A. M. Bruni, 650 ft. from NE line, 620 ft. from SE line of Blk. 43, Killam Subd., J. V. Borrego Grant Sur. ..... T.D. 1,824 ft; abd.

O. W. Killam's No. 3 A. M. Bruni, 150 ft. from NW and NE lines of Blk. 53, Killam Subd. B-8, Blas Uribe 2,561 acres in San Ignacio Subd. of J. V. Borrego grant ..... T.D. 785 ft.; drlg.

A. C. Savey et al's No. 1 Flores, 150 ft. from NW line, 206 ft. from NE line of Blk. 8, Share 1 of P. A. Richer Subd. of Porcion No. 36 ..... T.D. 600 ft; standing.

ZAVALA COUNTY

Zavala O. & G. Co.'s No. 1 Gates, 1,320 ft. from N line, 1,220 ft. from E line of Hooper & Wade Sur. No. 13.. T.D. 3,920 ft.; standing.

Southwest Texas Proven Areas

Week Ending March 25

HILBIG POOL—BASTROP COUNTY

Company, well, farm name, section and block— Remarks:

Humble O. & R. Co.'s No. 1 Beck, 279 ft. from NW line, 320 ft. from NE line of 45.5-ac. tract in Andrew Mayes Sur. ..... T.D. 2,592 ft.; comp. 50 bbls. hrly., shut in.

Humble O. & R. Co.'s No. 1 Betty White, Sur. 2, 2mi. SE from No. 1 Annie Hassler ..... T.D. 3,704 ft.; abnd.

Humble O. & R. Co.'s No. 1 Peter Goertz, 1,360 ft. to W line, 415 ft. to N line of 100-ac. tract ..... Derrick.

Humble O. & R. Co.'s No. 1 Pierce Wolfensbarger, 960 ft. to W line, 915 ft. to S line ..... Set surface csg.

Humble Oil & Refining Co.'s No. 1 Ed Wilhelm, 235 ft. from W line, 330 ft. from S line of 223-ac. tract in Samuel Wolfensbarger Sur. ..... T.D. 715 ft.; drlg.

RIDDLE POOL—BASTROP COUNTY

Ogden & Reed's No. 3 Riddle, 600 ft. S and E of No. 1 Riddle in 94.5-ac. tract in Joshua Gray Sur. ..... T.D. 2,188 ft.; set csg.

Eastland Oil Co.'s No. 1 Riddle, 150 ft. from E line, 350 ft. from S line of 39-ac. tract in Leach Sur. .... Spudded in.

Marts and Beavens' No. 1 Riddle, 163 varas N of S cor., 54 varas from W line of 39-ac. tract in John Maxmillan Sur. ..... T.D. 2,303 ft.; bailing oil.

TULETA POOL—BEE COUNTY

Aztec Oil & Royalty Co.'s No. 1 Taylor, 1,000 ft. from N line, 330 ft. from E line of W NW Sec. 13, Ragsley Subd., Uranga grant ..... T.D. 4,104 ft.; abnd.

Grisham et al's No. 1 Rapp & Hatch, center of SW 40 acres of 217.5-ac. tract in Sec. 12 of Jose Maria Uranga Grant Sur. ..... Rigging up.

ECKERT POOL—BEXAR COUNTY

F. H. Eckert's No. 6 Louis Brehm, 320 ft. S of No. 5, 150 ft. to S line, 450 ft. to E line, Boquar Sur. ..... T.D. 664 ft.; drlg. plug.

NORTH GOVERNMENT WELLS POOL—DUVAL COUNTY

W. T. Daniels' No. 1 F. J. Smith, 330 ft. from N and W lines of SW of NE of Sur. No. 46 ..... T.D. 2,311 ft; waiting for csg.

Hester Bros.' No. 1 fee, 330 ft. from S and E lines of NE of Sur. No. 47 ..... Rigging up.

Humble O. & R. Co.'s No. 3 C. W. Hahl, 2,310 ft. to S line, 1,650 ft. to E line, Sur. 360 ..... T.D. 2,336 ft.; comp. 500 bbls. daily.

Humble Oil & Refining Co.'s No. 4 Hahl, 330 ft. from S line, 316 ft. from W line of E of Sec. 360 ..... T.D. 150 ft.; drlg.

Magnolia Petroleum Co.'s No. 4 Hahl-Welderkehr, 330 ft. from N and E lines of N of NW of Sur. No. 45 .. Rigging up.

Magnolia Pet. Co.'s No. 4 R. White, 330 ft. from N line, 990 ft. from W line of N NW Sur. 64 ..... T.D. 2,307 ft.; plugged back and milling out.

Navarro Oil Co.'s No. 4 Hahl, 340 ft. from S and W lines of W half of Sur. No. 360 ..... Rigging up.

Navarro Oil Co.'s No. 3 Hahl, 1,320 ft. from W line, 2,310 ft. from S line of Sur. No. 360 ..... T.D. 2,312 ft.; 100 bbls. daily.

Reynosa Oil Co.'s No. 5 C. W. Hahl, 330 ft. to N line, 990 ft. to W line of N½ of NE of Sur. 42 ..... Rigging up.

The Texas Co.'s No. 7 Johnson, 990 ft. from E line, 330 ft. from N line of S½ NW 3-4, Sur. No. 42..... Derrick.

SOUTH GOVERNMENT WELLS POOL—DUVAL COUNTY

Humble O. & R. Co.'s No. 11 Paul White, 990 ft. from S line, 1,320 ft. from E line of Sur. No. 249 ..... Derrick.

SARNOSA POOL—DUVAL COUNTY

Atravasada Oil Co.'s No. 1 P. Henrandez, 330 ft. to NW and SW lines of E half of Sur. 574 ..... T.D. 2,488 ft.; bailing.

The Texas Co.'s No. 1-B Duval County Ranch Co., 320 ft. from NE line, 285 ft. from SE line of Sur. No. 576. T.D. 2,332 ft.; set csg.

SAL-MAR POOL—GUADALUPE COUNTY

Sal-Mar Oil Co.'s No. 1 Chas. Woehler, 1,040 ft. from N line, 300 ft. from E line of G. W. Williams No. 46.. Rigging up.

ALWORTH FIELD—JIM HOGG COUNTY

H. C. Cate's No. 1 B. J. Leyendecker, 70 ft. to E line, 320 ft. to S line, Blk. 10, Sur. 143 ..... T.D. 1,142 ft.; abnd.

SANDIA POOL—JIM WELLS COUNTY

Crude Oil Royalty Co.'s No. 1 Allen (first carried as Hughes & Long's No. 1 Wade), Cen. Blk. 2, Wade ranch ..... Drlg. 876 ft.

SAXET POOL—NUECES COUNTY

Holliday et al's No. 1 Smith, 330 ft. from S and E lines of 700-ac. tract ..... T.D. 4,874 ft.; drlg. in.

Gibson Oil Co.'s No. 2 Rand Morgan, 1,320 ft. from N line, 330 ft. from E line of lease ..... T.D. 1,475 ft; drlg.

Gulf Port Oil Co.'s No. 3 Frank Bliss, 1,650 ft. to N line, 350 ft. to E line of 235-ac. tract in J. W. Stevens Sur. No. 466 ..... T.D. 4,559 ft.; showing oil.

Gulf Port Oil Co.'s No. 2 Humphreys, 115 ft. from N line, 330 ft. from W line of lease (8 offset to No. 1 Gibson, Rand Morgan Sur.) ..... Rigging up.

Gulf Port Oil Co.'s No. 1 Rand Morgan, 330 ft. from N and E lines of 80-ac. lease ..... T.D. 4,858 ft.; set csg.

Houston Oil Co.'s No. 3 McGregor, 337 ft. from E line, 330 ft. from S line of tract ..... T.D. 4,864 ft.; set csg.

Shasta Oil Co.'s No. 1 Quiros, 330 ft. from N and E lines of Lot 39, Sur. No. 911 ..... T.D. 5,050 ft.; abnd.

Texas Coast Oil Co.'s No. 1 Clark-Morgan, 330 ft. from S and E lines of N½ of Sur. No. 404..... T.D. 4,911 ft.; abnd.

Violet Oil Co.'s No. 1 McGregor-Polk ..... T.D. 4,874 ft.; abnd.

MATHIS POOL—SAN PATRICIO COUNTY

Geo. W. Scruggs' No. 1 Collins ..... T.D. 600 ft; drlg.

WHITE POINT FIELD—SAN PATRICIO COUNTY

Saxet Oil Co.'s No. 19 Rachel ..... T.D. 6,788 ft.; drlg.

LOS OLMOS POOL—STARR COUNTY

Floyd-Doyno-Toiands' No. 1 Seabury, 840 ft. from S line of Doyno 80 acres, Share 5, Por. 75, Camargo Sur.. T.D. 460 ft.; standing.

Goodwin & Yantis' No. 1 Kelsey Bass, 150 ft. to S and E lines of SE of NW of Sur. 2, Porcions 75, 76, 77. .. Rigging up.

Goodwin & Yantis' No. 1 Seabury, 150 ft. from N and E lines of N 80 ac. of Share 5, W portion of Porcion 75, Camargo ..... T.D. 1,275 ft; drlg.

Hooks & Weavers' No. 14-A2 Kelsey Bass, 300 ft. from W line, 350 ft. from S line of E 80 acres of NE SW Sec. 6, Pors. 75, 76, 77, Camargo ..... Drlg. 1,126 ft; S.D.

LAUREL POOL—WEBB COUNTY

Dyck Oil Co.'s No. 2 Garcia-Villareal, 480 ft. from N line, 150 ft. from E line of NE NW of Sur. No. 1,100. T.D. 2,294 ft.; 100 bbls. hrly.

Montex Oil Co.'s No. 1 Garcia & Villareal, 150 ft. from NW and SW lines of W half of S half of Blk. 14, Sur. 720 ..... Rigging up.

Sal-Mar Oil Corp.'s No. 1 Vela, 460 ft. from NW and SW lines of Blk. 16, Sur. No. 1,011 ..... Rigging up.

South Texas Oil Co.'s No. 12 Laurel, 211 ft. from E line, 750 ft. from S line of Blk. 6, Sur. No. 271 ..... T.D. 2,220 ft.; 80 bbls. daily.

Wise & Jackson's No. 1 Garcia & Villareal, 450 ft. to E line, 150 ft. to N line of SE NW Sur. 1,100..... T.D. 2,217 ft.; swabbing.

MOCA POOL—WEBB COUNTY

Whisenant & Trenchard's No. 1-A Duval County Ranch Co., 650 ft. to N line, 150 ft. to W line of Blk. 13, Sur. 101 ..... T.D. 600 ft.; drlg.

ESCOBAS POOL—ZAPATA COUNTY

Lefevre et al's No. 1 M. Garza Hrs., 330 ft. from NW and SW lines of Blk. 53, C. A. Douglas Subd., Zerro ranch, Comitas Grant Sur. ..... T.D. 1,120 ft.; drlg.

McCormick et al's No. 1 Bustamente, 300 ft. from NE. line, 375 ft. from NW line of SE¼ of Share 35, Comitas grant ..... T.D. 1,502 ft.; abnd.

B. W. Roscoe's No. 2 Bustamente, 300 ft. from NE line, 375 ft. from NW line of SE of Share 33, Comitas grant ..... T.D. 800 ft.; drlg.

The Texas Co.'s No. 21 Measles, 3,425 ft. from SE line, 19,545 ft. from SW line of Cerrito Blanco grant..... T.D. 1,240 ft.; 80 bbls. daily.

The Texas Company's No. 20 Measles, 3,750 ft. from SE line, 19,084 ft. from SW line of Cerrito Blanco grant ..... Spudded in.

MARTINEZ POOL—ZAPATA COUNTY

P. H. Neilson's No. 1 A. Trevino, 200 ft. from S line, 770 ft. from E line of Blk. 10, Sur. No. 411..... T.D. 1,900 ft.; drlg.

Wildcat Operations in Louisiana-Arkansas

(Continued from Page 102)

VERNON PARISH

Gibson & Johnson's (was Earl Jones') No. 1 Willis, 350 ft. N, 400 ft. E, SW cor. SE SE Sec. 32-3n-9w..... Coring shale and sand 2,987 ft.

Arkansas

LINCOLN COUNTY

Lawrence M. Cook, tr.'s No. 1 McGhee Planting Co., 420 ft. S, 220 ft. W, NE cor. NE SW ..... Drlg. 4,220 ft.

LITTLE RIVER COUNTY

American Portland Cement Co.'s No. 1 fee, 150 ft. S and E, NW cor. SW NE Sec. 21-12-32 ..... Drlg. 2,040 ft.

MILLER COUNTY

J. T. Humphrey's No. 1 Grace, C SW SW Sec. 9-15-27... Began drlg. Mar. 16; S.D. 20 ft.

Roy Kniveton's (was Simon & Birdwell's) (was C. E. Starr's) No. 1 Barker, 330 ft. S, 150 ft. E, NW cor. NW SE Sec. 31-17-26 ..... Drlg. chalk 2,400 ft.

UNION COUNTY

Tom Nash's No. 1 Union Sawmill, 200 ft. N and E, SW cor. NW NE Sec. 19-18-11 ..... Drlg. shale 970 ft.

East Texas

CASS COUNTY

T. H. Pardoe, operator's No. 1 S. A. Orr, in the G. W. Morris Sur., 390 ft. east of the W line of the G. W. Morris Sur., also the east line of the David Frazier Sur. ..... Drlg. sandy shale 1,632 ft.

Louisiana-Arkansas Proven Areas

North Louisiana

CADDO—BLANCHARD AREA

Company, well, farm name, section and block—	Remarks:
Louana O. & G. Co.'s No. 1 Waskom, 660 ft. N and E, SW cor. Sec. 29-19-16	Drlg. pyrites 2,553 ft.

CADDO—BETHANY

Tom Collins Pet. Co.'s No. 1 Gill & Lipscomb, 660 ft. N, 1,506 ft. E, SW cor. Sec. 17-16-16	Derrick.

CADDO—HOSSTON

Caddo Prairie O. & G. Co.'s No. 1 Hawkins, C SE SW Sec. 14-22-15	S.D.; W.O. 1,826 ft.
Gibson Oil Co.'s No. 1 J. H. Dominick, 330 ft. S and W, NE cor. SW NE Sec. 31-23-14	Drlg. 1,203 ft.
The Texas Co.'s No. 20 D. H. Raines, 1,170 ft. E, 150 ft. N, SW cor. SE Sec. 15-21-15	W.O.S.R. 1,700 ft.

RHODESSA AREA

Pyramid O. & G. Co.'s No. 1 Shuttleworth, C SW NE Sec. 3-18-16	Derrick.

RED RIVER PARISH

W. W. Smith's No. 1 Wilkinson, 100 ft. S, 580 ft. W, NE cor. SW NW Sec. 3-12-10	Moving in rig.

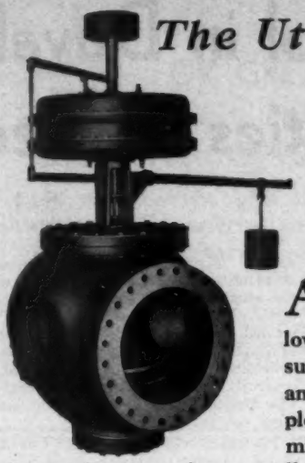
SABINE PARISH—ZWOLLE

Byers et al's No. 1 Ervin & Bishop, 550 ft. E, 450 ft. N, SW cor. Sec. 16-7-11	Drlg. 1,310 ft.
Coming Oil Co.'s No. 1 T. L. Andries, 415 ft. E, 365 ft. S, NW cor. NE SE Sec. 15-7-11	Set 6-in. 2,398 ft; bailing to test; T.D. 2,550 ft.
Doyle et al's No. 1 M. D. Russell, 330 ft. N and W, SE cor. NE SE Sec. 23-8-12	Drlg. 1,620 ft.
Graham Prod. Co.'s No. 1 Lites, 330 ft. S and E, NW cor. SE SW Sec. 28-8-11	Set 6-in. 2,197 ft; bailed dry; W.O.; T.D. 2,600 ft.
D. M. Lides' No. 1 Steinhorst, 330 ft. S and W, NE cor. Sec. 35-8-12	Began drlg. Mar. 17; 10-in. 40 ft; drlg. 1,230 ft.
C. H. Lyons et al's No. 1 Stille, 330 ft. S and W, NE cor. SE Sec. 16-7-11	Rigging up.
Martin et al's No. 1 Porter, 330 ft. S, 330 ft. W, NE cor. NW SW Sec. 30-8-11	Began drlg. Mar. 17; 10-in. 40 ft; drlg. 275 ft.
H. C. Moulding's No. 1 Brumley, 330 ft. N, 330 ft. E, SW cor. NW NW Sec. 2-7-11	Cmtd. 6-in. top marl 2,355 ft.
Nowlin & Cherry's No. 1 Turner, 109 ft. N, 330 ft. W, SE cor. fractional NW NW Sec. 4-7-11	Dry; S.O. 2,444 ft.
Ohio Oil Co.'s No. 1 A. C. Phillips, 330 ft. S and W, NE cor. SW SW Sec. 30-8-11	Rigging up.
Pelican Nat. Gas Co.'s No. 30 La. Long Leaf Lbr. Co., 330 ft. S and W, NE cor. SE NE	Bailing to test 2,716 ft.
Pugh-Hickman Drlg. Co.'s No. 3 Blackman, 330 ft. S and W, NE cor. NW NW Sec. 36-8-12	Cmtd. 6-in. 2,365 ft; bailed dry 2,407 ft.
Robertson Drlg. Co.'s No. 1 J. W. Hughes, 1,320 ft. W, C, Sec. 36-8-12	Top marl 2,252 ft; S.D. for csg.
Scully & Beach's No. 3 Lafitte, 1,030 ft. S, 134 ft. E, NW cor. Sec. 13-7-11	Hole clean; arranging to deepen; T.D. 2,492 ft.
H. R. Smith et al's No. 1 Middleton, 330 ft. N and W, SE cor. SE SE Sec. 26-8-12	Began drlg. Mar. 18; 10-in. 40 ft; drlg. 620 ft.
C. H. Tuttle's No. 4 Byrd, 800 ft. S, 920 ft. E, NW cor. NW NW Sec. 7-7-10	Derrick.

Arkansas

UNION COUNTY—EL DORADO

F. C. Henderson's No. 1 J. F. Sample, 330 ft. S and W, NE cor. NW NW	Rigging up.



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Driscoll Pool in Duval County, Texas, Presents Possibilities of Deeper Sand Production

By I. R. SHELDON
Consulting Geologist, San Antonio, Tex.*

The Driscoll ranch is located in the south central part of Duval County, about 8 miles from the south and 9 miles from the west boundary. It consists of 53,000 acres in a solid block, extending 10 miles north and 9 miles east to within 2 miles of the settlement of Sweden. The ranch is used entirely for cattle raising and only a few acres are cultivated. The only inhabitants are Mexican cowboys with their families and two Americans at the oil wells. No public roads cross the ranch and few trails; a large part of it can only be reached by walking or on horseback.

Climate

Duval County is in the semiarid part of Southwest Texas. The rainfall is between 20 and 25 inches per year but most of it falls in the winter months and in sudden violent storms. Six-month periods without rain are usual. The temperature ranges from freezing in winter to 120° in summer but the dry atmosphere and constant breeze make most of the year comfortable.

Topography

The entire ranch is rolling with about 200 feet of relief. The highest elevation is over 600 feet in the northwest and the low point is about 400 feet in the southeast part of the ranch. There are no permanent streams but the dry creek beds are about 100 feet below the tops of the hills. Rosita Creek drains the north part of the ranch and Concepcion the south. This is the only part of Southwest Texas that has not been mapped by any branch of the Government and no topographic maps of the area are available.

The average slope of the area is 8 feet to the mile southeast. The hills are formed by more resistant beds in the soft Reynosa formation. This dips gently southeast and consequently the surface is divided into a series of low, roughly parallel cuestas (sloping plain) with the steeper slopes on the northwest side. These cuestas are cut by creeks and rounded hills with a gentle southeast slope.

Vegetation

The entire ranch is covered with a thick growth of thorns and brush characteristic of Southwest Texas. These grow to the size of small trees in the valleys. Elm, hackberry, mesquite, Brasilwood, mahogany, yucca, Spanish dagger and many varieties of cactus make up the brush. Corn and cotton can be grown in the sandy areas and a great variety of vegetables and semitropical fruits will flourish under irrigation.

Surface Geology

The surface of the Driscoll ranch is covered by the Reynosa formation. This material is thought to be of comparatively recent age and to lie as a mantle unconformably over rocks of Pleistocene and Pliocene age. The Reynosa is characterized by white or pinkish porous caliche limestone generally without form and lenticular. This is interbedded with pink, brown and grey argillaceous sands. A small area in the northwest corner of the ranch exposes the underlying Oakville sandstone and its contact with the Catahoula Tuff.

An attempt has been made to map the surface formations. This was found to be of no value except in the areas where the hills are covered with red sandy material. This sand is a lower Lissie formation and appears to reflect areas of uplift. Where it is found free from caliche and gravel it can be followed but generally conforms with the topography. The Driscoll Pool is located on one of these red sand hills.

The contact of Oakville and Catahoula shows a definite eastward bend which is important. The axis of this bend or fold plunges from northwest to southeast across the ranch and indicates a zone or belt of country favorable for the accumulation of oil or gas.

Subsurface Geology

The geologic column for the Driscoll Pool is as follows:

Age—	Formation	Top	Bottom	Thickness	Producing sands
	Caliche and gravel	0	80	....	
Pliocene	Lissie	0	460	....	
Miocene	Oakville	460	770	310	Gas
	Catahoula Tuff	770	1,770	1,000	
Oligocene	Frio	1,770	2,800	1,020	Saxet, Refugio
Eocene	Fayette	2,800	3,080	280	Cole, Driscoll
	McElroy	3,080	3,810	730	Government Wells, Mirando
	Diboll	3,810	3,950	140	
	Cockfield	3,950	4,300	350	Pettus
	Yegua	4,300	4,700	400	Tuleta

These formations have a regional dip to the southeast ranging from 120 feet per mile for the oldest or lowest to 20 feet per mile for the youngest or highest.

Subsurface correlation can be made from well logs only where the well has been carefully drilled and systematic cuttings have been caught. No definite limes occur within this geologic column and correlations must be made almost entirely on sands and sandy shale. A microscopic examination of the cuttings by a paleontologist and frequent coring is almost indispensable to the identification of formations and the location of producing horizons.

The Oakville sand is shallow in this area and carries water and sometimes gas. It furnishes water for many of the windmills and a careful study of their records reveals possible structure.

In many cases gas found in these wells has been the first indication of structure and has led to deeper drilling. The Driscoll Pool was discovered in this manner. It is possible that shallow core drilling to this Oakville horizon would be valuable.

The top of the Fayette or Jackson formation is the best known horizon in Southwest Texas. All drillers and geologists are trained to look for it and usually record it on well logs. It is marked by a sudden change from the Frio gray and green shales and gumbos to dark lignitic sandy shales which are replaced by the hard top of the Cole sand. This sand is frequently missed or replaced by sandy shale but careful drilling will not miss this marker. The producing horizon in the Driscoll Pool is a lenticular sand which is found about 100 feet below the top of the Fayette and the so-called Cole sand of the Government Wells area is believed to correlate with it.

A subsurface map of this part of Duval County has been prepared from well logs and all data available. This map reveals an eastward swing or bulge in the contours around each pool producing along the west line of the county and the axes of these bulges are accepted as the trends of the producing areas. The axes of the individual pools are at right angles to these trends. The trend southeast from the Kohler Pool passes through the Driscoll Pool.

The Cole sand is the producing sand at the top of the Fayette formation. It produces gas in large quantities all along the Reynosa escarpment and in spots is productive of oil. This formation is now known to contain several lenticular sands and a careful study of the individual areas will have to be made before it can be known whether or not the production is coming from the top of the Fayette or from one of its other sands. About 780 feet below the top of the Fayette is the Government Wells sand in the McElroy formation and 170-200 feet below this is the Mirando sand. These two sands produce most of the oil in the Laredo district. The Pettus sand is near the top of the Cockfield about 550 feet lower. It is impossible to definitely differentiate these horizons without careful well records and accurate paleontology.

	1929
January	.....
February	.....
March	3,045
April	3,815
May	12,767
June	6,920
July	7,980
August	6,919
September	6,930
October	6,709
November	4,221
December	6,186
Total	64,842

Driscoll Pool Production

The Driscoll Pool is the only producing area on the Driscoll ranch near Sweden. This pool was discovered in 1908 by the fee owner, Robert Driscoll, from gas found in water wells. It has never been leased and all of the development has been directly under the supervision of the owners.

A detailed record of the wells drilled follows:

Well	Completed	T.D.	Elev.	Subsurface top sand	Thickness of sand	Initial production
1	1908-09	608	541	36	..	3,000,000
2	1908-09	....	....	(*)	....	.....
3	1908-09	528	545	17	23	3,000,000
4	1908-09	517	544	27	12	6,000,000
5	1908-09	517	546	29	10	4,000,000
6	1908-09	532	531	20	12	2,000,000
7	10- 8-27	2,468	531	—1,916	30	15,000,000
8	12-22-27	2,441	532	—1,905	4	50,000,000
9	2-29-28	2,998	529	—2,406	40	(†)
10	2- 6-28	2,480	546	—1,931	3	30,000,000
11	4-21-28	2,461	534	—1,923	4	‡60,000,000
12	8-26-28	2,906	532	—2,351	15	§40,000,000
13	.....	2,475	571	—1,897	7	40,000,000
14	2-20-29	2,894	550	—2,336	4½	¶875
15	4-30-29	2,899	557	—2,336	3	¶550
16	6-25-29	2,955	553	—2,342	17	75,000,000

*No record. †Oil and water. ‡Deepened. §February 1, 1930, oil well. ¶Barrels of oil.

The lower sand was found in No. 9 but carried too much water to be a commercial well. Well No. 12 found the sand in August, 1928, but made only gas. In February, 1929, well No. 14 proved the presence of oil by flowing 875 bbls. per day. Well No. 15 soon proved the presence of a pool when it was completed flowing 590 bbls. per day. No. 11 was then deepened to this sand and made commercial production but no record was kept of this deepening. These three wells have produced all of the oil from the pool and are still flowing their production.

All of the wells were drilled under the direction of R. L. Driscoll and his sister, Mrs. Clara Driscoll Sevier by Ed Meins as superintendent and Bob Evans as head driller. The Houston Pipe Line Co. is connected to the gas wells and the Humble Pipe Line Co. is taking the oil. The oil is of the regular Mirando quality of 23° to 24° Be. The gas is being sold at the rate of 500,000 feet per day.

The monthly pipe line runs are as follows:

1930	1931	1932	
4,966	11,122	4,434	
6,332	7,733	6,294	
5,363	5,155	7,473	
9,987	7,943	6,494	
12,058	7,992	5,963	
12,409	6,866	4,759	
11,805	5,267	5,000	
11,108	5,088	5,500	
9,578	5,909	5,391	
8,984	6,894	4,515	
7,384	5,754	6,450	
5,458	4,217	6,386	
104,432	82,943	68,759	320,976

Future Production

Future production from these three wells can be plotted with considerable certainty. The wells have always flowed to capacity and no artificial means have ever been employed to increase their production. At the present time they are making about 100 bbls. of water per day but this does not seem to be increasing and has not interfered with their flowing.

The estimated future production based on the curve for 1930, 1931 and 1932 is as follows:

FUTURE TOTALS

Year—	Bbls.
1933	57,600
1934	43,800
1935	29,584
1936	18,504
1937	12,000
1938	7,800
1939	5,100
Total future	174,388

Per acre yield—	Bbls.
Total production through Dec., 1932	320,976
Estimated future production	174,388
Grand total for three wells	495,364
Assuming a drainage of 10 acres per well or a total drainage of 30 acres, the per acre ultimate yield will be	16,500

Productive Acreage

A study of the pool in Sections 23 and 448 shows that the present producing area is 4,000 feet east and west and 2,500 feet north and south and covers approximately 240 acres. The subsurface elevations of the Oakville, Frio and Fayette sands have been figured and contour maps prepared on them. A study of these maps shows that the Oakville and Fayette sand maps are similar but that the Frio sand map has a different outline. It is thought that the Frio sand is a lens of local significance which has happened to trap gas migrated upward from Eocene formations.

The Oakville sand is only 500 feet deep and carries fresh or sulphur water except where gas has driven them out. It is only considered important on account of its ability to reflect structure in the

*Author's title, "The Driscoll Pool, Duval County, Texas." Presented before San Antonio Section A.A.P.G., February 17, 1933, and Annual Meeting, Houston, Tex., March 23-25. In preliminary form, not officially edited. Courtesy A.A.P.G. Bulletin.

lower horizons. The similarity of its structure to that of the Fayette sand suggests that the folding which has caused this structure has been progressive through long periods of time. The maximum difference in subsurface elevation in the lower sand is 70 feet while that in the upper sand is 29 feet.

Although this pool lies rather close to two known salt domes there is nothing to suggest a salt dome structure here. Everything about the structure suggests that it is similar to the other producing areas in the Laredo district in that the accumulation of oil and gas is caused by a combination of sand lensing and folding. In the other fields the sand lenses out on the west side along a line trending about north 20° east and accumulation is found east of this line where it crosses a broad transverse fold that has a northwest-southeast axis. The sand is thicker on the flanks indicating that the folding was progressive during deposition. Sand conditions are fairly regular with a general thickening eastward.

Assuming that the Driscoll Pool is of this kind it is estimated that the producing area of the lower sand will be 500 to 640 acres.

Lower Sands

The Fayette is the upper producing horizon of the Laredo district and is the least productive. The Government Wells sand which lies 700 feet below the top of the Fayette in the McElroy formation is the most productive and the Mirando sand, 200 feet still lower, is nearly as good. The Pettus sand which lies at the contact of the Cockfield and Yegua formations, 500 feet below the Mirando sand, does not produce in Duval County but is found on both sides of it in Webb and McMullen Counties.

The chance of finding these lower sands in the Driscoll area is good. The Fayette and Government Wells sands are found closely associated in the Government Wells Pool and in other parts of the Laredo district. The well drilled by Calliham and others just northeast of the Driscoll ranch and about 8 miles north of the Driscoll Pool, found all of these sands; the Pettus sand was about 1,250 feet below the Driscoll sand which indicates a slight thinning of the interval between the horizons in this area.

A deep test in the Driscoll Pool should find the lower sands as follows:

	Feet
Government Wells sand	3,500
Mirando sand	3,700
Pettus sand	4,050
Yegua (Tuleta)	4,225

This area lies close to the same subsurface contour as Tuleta in Bee County and just up dip from the neritic or continental shelf phase of the Fayette sands. This means that the lower formations will thicken rapidly to the southeast and that this belt of country is especially favorable for oil accumulation.

Conclusions

The Driscoll Pool is producing gas from the Oakville, Frio and Fayette sands, and oil from the Fayette sand. The oil is 23° Be. gravity of Mirando quality. The present three wells will ultimately produce approximately 500,000 bbls. of oil or a per acre yield of 16,500 bbls. The pool should ultimately cover 640 acres. The structure is a sand lens controlled by folding. The Government Wells, Mirando and Pettus sands have not been tested but should be found in the area above 4,100 feet.

California Fields

(Continued from Page 106)

60 days before it reaches the interesting stage. No. 1 Cruz is in the extreme eastern part of the Montebello structure and is being drilled for the specific purpose of making a deep conclusive test of the Miocene as the overlying Pliocene is commercially unproductive at this point. Universal's test is well within the productive contours of the Pliocene and should pick up a productive zone in the Miocene if these rocks show an accumulation in this field. Edgewater encroachment has placed the Cruz property beyond the limits of commercial production, although during the early life of the field it was operated commercially. Following drilling operations by Universal Consolidated, the Community Oil Co. resumed work in No. 1 Germain and is cleaning out the hole at 4,903 feet preparatory to a resumption of drilling. Drilling operations did not show any great change in the Huntington Beach Field of Los Angeles Basin during the week, although Wilshire Oil Co. in issuing orders to suspend all development work, automatically shut down two drilling projects in this district. Standard Oil Co. has about finished rigging up rotary equipment in No. 113 Murphy Coyote, in the West Coyote Field of Los Angeles Basin.

CORNELIUS MURPHY DEAD

Cornelius Murphy, age 73 years, died in Bradford, Pa., on March 19 after an illness of four weeks. Mr. Murphy went to the Bradford Field in 1877, making his home in Summit City. He accumulated valuable oil property in the field and a few years later moved to Bradford. Mrs. Murphy survives, together with four sons, Henry and Merle, of Bradford; Earl, of Duke Center, Pa., and Leo, of Okmulgee, Okla.

THOMAS C. KING DEAD

Thomas C. King, head of the claims department of the Gypsy Oil Co., died in Tulsa on Thursday, March 23, following an illness of heart disease. Mr. King had been in the service of the Gypsy Oil Co. for 18 years. Mrs. King and two daughters survive.

ALEXANDER DEUSSEN
Consulting Geologist
Specialist, Gulf Coast
1606 Shell Building
Houston, - - - - Texas

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U. S. PATENT NUMBER	*DATE OF PATENT*
1,672,495	June 5, 1928
Reissue 17,242	March 19, 1929
1,675,121	June 26, 1928
1,676,619	July 10, 1928
1,724,495	August 13, 1929
1,724,720	August 13, 1929
1,899,970	March 7, 1933
1,599,538	September 14, 1926
1,451,080	April 10, 1923

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Exports and Imports of Refined Products

(Continued from Page 34)

(all figures in gallons unless otherwise noted):

	Week ended Mar. 18	Mar. 11	Mar. 4
Gasoline	352,000	315,000	2,000
Naphtha	322,000	348,000	.....
Kerosene	17,000	25,000	142,000
Fuel and gas oil	6,000	22,000	.....
Lubricating oil	1,543,000	2,052,000	2,629,000
Petroleum, ref'd.	565,000	512,000	40,000
	Pounds		
Petrolatum	30,000	.....	106,000
Paraffin wax	820,000	1,361,000	1,380,000
Refined	112,000	90,000	.....
Scale	235,000	270,000	164,000
Lub. grease	585,000	310,000	645,000

Easiness in the position of the export markets at the Gulf during the past week was reflected by a slackening off in export buying interest in the refined products markets here, export operators withholding inquiries in anticipation of a sympathetic weakening of the price basis at Atlantic export centers.

Imports

Imports of crude and refined petroleum at principal United States ports for the week ended March 18 totaled 1,136,000 bbls., a daily average of 162,286 bbls., compared with 982,000 bbls., a daily average of 140,286 bbls., for the previous week, and a daily average of 152,357 bbls. for the four weeks ended March 18. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast Ports—	
Baltimore	66,000
New York	754,000
Philadelphia	111,000
Others	205,000
Total	1,136,000
Daily average	162,286
Daily average four weeks	152,357

There were no imports at Gulf Coast ports during the week.

Arrivals of foreign oil at Atlantic Coast ports during the week comprised 773,000 bbls. of crude and 363,000 bbls. of fuel oil.

California Oil Reports

Receipts of California crude and refined petroleum at Atlantic and Gulf Coast ports for the week ended March 18 totaled 558,000 bbls., a daily average of 79,714 bbls., compared with 330,000 bbls., a daily average of 47,143 bbls., for the previous week, and a daily average of 51,107 bbls. for the four weeks ended March 18. Details follow:

	Bbls. of 42 gals.
At Atlantic Coast Ports—	
New York	152,000
Philadelphia	192,000
Others	131,000
Total	475,000
Daily average	67,857
At Gulf Coast Ports—	
Port Arthur	83,000
Daily average	11,857
At Atlantic and Gulf Coast Ports—	
Total	558,000
Daily average	79,714
Daily average four weeks	51,107

Arrivals of California oils were classified as follows:

At Atlantic Coast Ports—	
Gasoline	421,000
Kerosene	54,000
At Gulf Coast Ports—	
Fuel oil	83,000

At the close of the week the following cargoes of California petroleum were reported afloat for East Coast ports:

For New York, 8,000 bbls. of lubricating oil on the Associated Oil Co. tanker Tulsagas; 80,000 bbls. of gasoline on the tanker Dilworth; and 80,000 bbls. of furnace oil on the Socony-Vacuum tanker Lio.

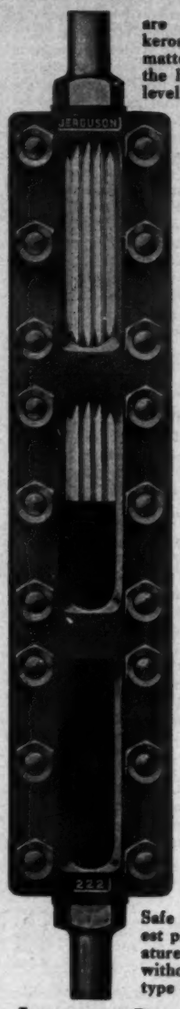
For Tiverton, R. I., 70,000 bbls. of furnace oil on the Associated Oil Co. tanker Tulsagas.

For Philadelphia, 117,000 bbls. of gasoline on the Sun Oil Co. tanker Sun.

Aside from intercompany shipments, it is not expected that much California gasoline will find its way eastward under present market conditions in this territory, although a regular movement of California kerosene to the eastern seaboard is expected to continue. Furnace oil shipments to the East from California are nearing an end for the current season, although gas oil is expected to be continued to be shipped during the summer months, on standing contracts with commercial consumers in the East.

JERGUSON

REFLEX GAGES



are ideal for gasoline, kerosene, steam, oil. No matter what the color of the liquid, they show the level in BLACK.

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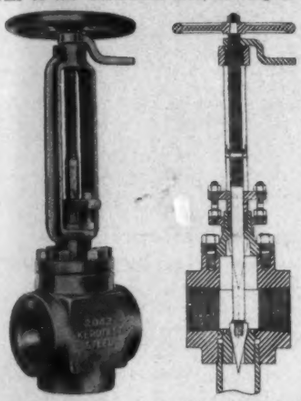
NEW AND IMPROVED EQUIPMENT

Throttling of Flow Made Easy by Kerotest Chokes

Kerotest steel adjustable control chokes developed by the Kerotest Manufacturing Co., Pittsburgh, Pa., are designed to afford an efficient and economical method of throttling the flow on prorated wells, and of controlling back pressures on sand producing wells. They are made in all sizes from 2 to 6 inches to meet every field condition and every design of hookup. The 2, 2½ and 3-inch sizes are made from forged steel. The 4 and 6-inch sizes are from cast steel.

T type control chokes are used on flow arms of the Christmas tree, serving as a



combination T and choke, changing the direction of flow at right angles. Bolted bonnets make it easy to change orifice bushings or needles when in service without straining other connections.

Cross type control chokes are so designed that the needle valve can be withdrawn clear of the runway by opening the stem to the extreme open position. This gives a clear passageway through the choke equal to the size of pipe connection and enables the swab to be passed directly through it without disconnecting any part of the choke.

The full opening cross type has 3-inch pipe size outlets on all openings. The areaway through this choke is equal to the inside diameter of 2½-inch external upset tubing, and the needle control when in the wide open position will permit of flow through the choke equal to the capacity of the tubing. This type can also be regulated down to very minute areaway for the passage of the fluid. The needle control can also be withdrawn clear of the passageway to permit swabbing without removing from the hookup.

The indicator is extremely accurate and shows in fractional sizes the dimensions of areway or area of orifice opening from zero to maximum size of orifice.

JOINT TRADEMARK IS ADOPTED

The line of compensated temperature, pressure, flow and combustion control instruments manufactured and sold by the Mason Regulator Co. ad Neilan Co., Ltd. (division of Mason Regulator Co.) will carry a new trademark, which bears the name "Masoneilan." This trademark will be used by both companies on all instruments instead of each company using its individual trademark as heretofore. The new trademark is pronounced "Mason-Neilan" and will be used universally to designate all compensated instruments made by the Mason Regulator Co. and the Neilan Co., Ltd.

Single and multiple-part wire rope alings and fittings are described and pictured in a 28-page catalog obtainable by writing to the MacWhyte Co., Kenosha, Wis.

Among the Equipment Houses

The Kibele Manufacturing Co., San Antonio, Tex., maker of pump pistons and swabs, is being represented in the Gulf Coast district by the Oil Equipment Sales Corp., 1812 Semmes Street, Houston, Tex. Charles H. Lane is head of the latter organization, and C. K. Stillwagon is salesmanager. Charles Morrison, well known in both field and sales work, is on the staff.

—

T. K. Mial, regional vice president of the Johns-Manville Sales Corp., New York, has been appointed an executive vice president. Mr. Mial will be general salesmanager of the power products department, directing the sales of the company's insulation, packings, power specialties, electrical products, pipe line protection, etc. J. A. O'Brien has been appointed assistant general salesmanager for the department.

—

The Doheny Stone Drill Co. has opened a branch plant in Houston, Tex., at 4300 Calhoun Street. S. S. Parker is superintendent.

—

John Beard, formerly with the Sharples Specialty Co., of Philadelphia, is now associated with the Haveg Corp. of Newark, Del. The Haveg Corp., an old associate of the Continental-Diamond Fiber Co., also Newark, has just completed a plant for the manufacture of corrosion resistant chemical equipment.

—

The Theo. M. Martin Co., has established offices at 5905 Pacific Boulevard, Huntington Park, Calif., to specialize in advertising and sales promotion of tools and equipment for the oil and gas industries. The company is headed by Theo. M. Martin, formerly of Berry & Martin, Inc., and with him are associated Wallace A. Sawdon and Lloyd C. Woods. Mr. Martin formerly was advertising manager for the oil tool division of Byron Jackson Co.

—

The Scovill Manufacturing Co., Waterbury, Conn., has been licensed by the Dardelet Threadlock Corp. to manufacture and sell "rivet bolts" and other bolts and nuts with the Dardelet self-locking thread.

—

The Northern Equipment Co., Erie, Pa., has appointed the J. W. Murphy Co., Chicago district representative for Copes feed water regulators, differential valves, pump governors and allied equipment. The office is at 431 South Dearborn Street.

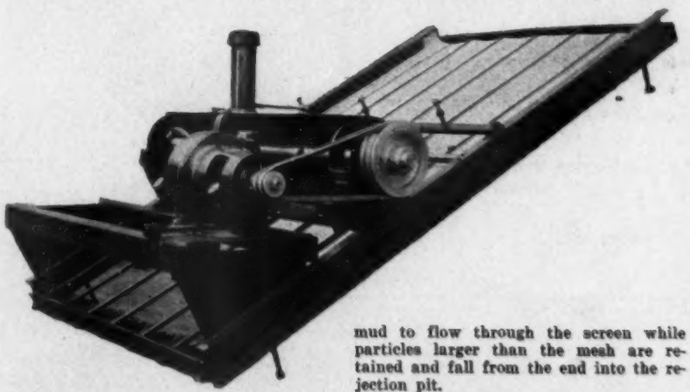
—

George W. White, president and director of Imperial Chemical Industries, New York, Ltd., has been elected a director of United Carbon Co.

—

Arthur E. Blackwood, with the Sullivan Machinery Co., Chicago, since 1897 and for the last four years its president, has been made chairman of the board of directors. He is succeeded as president by Henry S. Beal, formerly general manager of the Jones & Lamson Machine Co., Springfield, Vt.

Shaffer Screen Reclaims and Cleans the Rotary Mud



The Shaffer vibrating mud screen, developed by the Shaffer Tool Works, Brea, Calif., provides an effective and economical method of reclaiming and cleaning rotary mud at the well. Even gassing mud can be treated with this device. The Shaffer screen is simple in its mechanism and is said to have been proven under various kinds of drilling conditions. It is designed for long life and ease of adjustment. Any work on it can be done with ordinary tools at the derrick. There are no complicated parts.

The screen, which is 48 inches wide by 55 inches long, is set on a 24 degree inclination and is placed in the mud system so that as the mud emerges from under the derrick floor it flows over the screen. The rapidity of vibration causes all the mud to flow through the screen while particles larger than the mesh are retained and fall from the end into the rejection pit.

Special adjustments on the screen deck, together with the peculiar method of vibrating the machine make it unique and exceptionally efficient. The vibrating mechanism and the method of mounting the screen (rubber insulated from metal parts) is such as to give the screen almost indefinite life.

A 2-inch rotating cam shaft equipped with two one-eighth inch offset eccentric bearings produces a one-fourth vibration with each revolution. Two connecting rods run to a cross bar, which is attached to the screen assembly. A steam-driven turbine equipped with a governor permits regulation of vibrations to the most efficient speed of operation. Copies of a folder giving detailed information on this mud screen may be obtained from the company.

Men Well Known in the Equipment Field

The Eagle-Picher Lead Co., Joplin, Mo., has completed organization of its new insulation contract department, with C. B. Lynde, Dallas, Tex., as manager.

C. B. LYNDE

Mr. Lynde, whose headquarters will be in Joplin, is widely known throughout the oil producing and refining industry and for the past three years he has been connected with the Industrial Insulation Co., Dallas.

Feed-Water Regulator of Improved Design Offered

The Northern Equipment Co., Erie, Pa., announces an improved design of the Copes series type feed-water regulator. This regulator feeds the boiler in accordance with steam flow, with compensation for water level. The new design has been developed as a result of tests made at Bohlen power station in Germany. A new type of mechanical transmission makes it possible to locate the steam flow thermostat near the connections to the steam header. This simplifies erection and adjustment of the regulator, assuring more accurate results.

With the new series type regulator it is an easy matter to increase or decrease the influence of either steam flow or water level thermostat. This means that almost any desired proportion between steam flow and water level can be obtaind without difficulty.

The series type regulator can be quipped with either direct-acting or hydraulically operated control valve, or with a combined feed flow and water pressure regulating valve. Present installations of Copes feed-water regulators equipped with tension type thermostats may be changed over to series type regulators at moderate cost.

The Chain Belt Co., Milwaukee Wis., has appointed A. S. Kennedy as manager of its new branch office in Kansas City, Mo. Rex chains and conveyers were formerly marketed in this territory by the St. Louis office.

NATURAL GAS DEVELOPMENTS

Gas Company Executive Asks Fair Consideration

FORT WORTH, Tex., Mar. 27.—President L. B. Denning, Dallas, of the Lone Star Gas Corp., in condemning the growing demand for regulation of public utilities before the Fort Worth Kiwanis Club, asked the public not to lay too oppressive a burden on public service, "for they will give, so far as possible, a fair, honest return on what is paid for."

Mr. Denning said public utilities are "hedged in with all kinds of rules, and there is a tendency to build up this hedge, preventing us from taking advantage of conditions that otherwise would be possible."

"These have been difficult times for us," he said, in referring to the rate fight against the Lone Star Co. which distributes gas to many Texas towns and cities. "We knew there was some reason and grounds for the misunderstanding, and that we were partially to blame. But we couldn't afford to admit it at the time.

"We know we have made mistakes, but we are trying not to make the same ones over again," he announced.

"This is a business that has to keep going regardless of whether we make any profit in poor times and we aren't going to lower our standard of service to make a profit. There is but one standard to the 300 towns we serve, and that is to provide all the gas our consumers will need every day of the 365 in the year.

"Let's all be friendly, and work together," he asked.

The rate hearing before the Texas Railroad Commission which has been in progress in Fort Worth for many weeks, expects to end with the cross-examination of E. A. Steinberger, Dallas, Lone Star Gas Co. valuation engineer. J. H. Dunn, production engineer, and Frank Kendrick, geologist for the utility company, will next take the stand for cross-examination on gas reserve value testimony they gave on direct examination last November.

At Oklahoma City the Lone Star Gas Co. was granted a supersedeas bond by the Oklahoma Corporation Commission to permit continuance of former gas rates pending an appeal to the Oklahoma Supreme Court from a recent order reducing charges in 26 southwestern Oklahoma communities.

The company must furnish $120,000 bond annually and impound the difference between the old and new rates for reimbursement of consumers in case the court upholds the commission's order.

W. B. Trammell Heads Houston Natural Gas

HOUSTON, Tex., Mar. 27.—W. B. Trammell succeeded E. H. Buckner as president of the Houston Natural Gas Co. at an election of officers at the annual meeting here. Mr. Trammell has been vice president and general manager of the company since its organization six years ago. Mr. Buckner is retiring from active head of the company due to ill health.

Other officers elected included E. S. George, vice president; J. H. Wimberly, auditor and assistant secretary; D. P. Perkins, secretary and treasurer.

The directors elected were W. Tucker Blaine, Frank Smith, D. P. Perkins, W. B. Trammell and E. S. George, the latter the only addition to the new board.

The old officers of the company in addition to Mr. Bucker and Mr. Trammell were A. H. Kennerly, secretary-treasurer, and H. W. Fairbrother, assistant secretary-treasurer and auditor.

Emergency Repair of Field Bends Made Simple by Adjustable Angle Sleeve

On high-pressure natural gas lines the need for quick but permanent repairs to field bends has presented a difficult engineering problem. On straight sections of pipe the split-sleeve type of repair is commonly used because of its simplicity, speed and efficiency. The development of a split sleeve that can be applied to various lengths and angles of bends has received special attention and study on the part of engineers of the S. R. Dresser Manufacturing Co. The result is a new adjustable angle split sleeve of ingenious design.

This new split repair sleeve is of rigid cast construction, available in sections that can be joined together to cover any length of bend. The fact that the sections can be rotated to different positions makes it possible to adjust the sleeve for various angles up to 20°. By arriving at this design the engineers have found it unnecessary to build a complete series of sleeves to fit the angles on each size of pipe. The same sleeve can be used with either two or three sections, depending on the length of the bend and the angle desired.

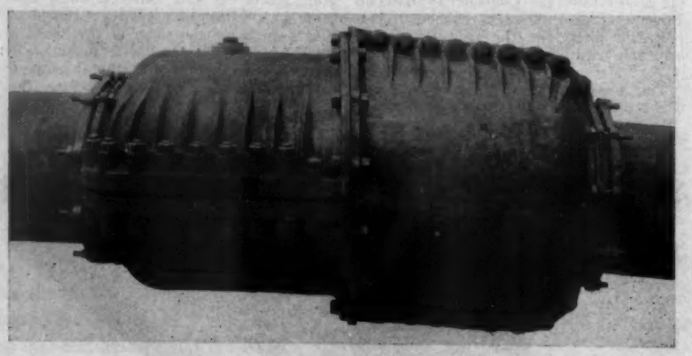
By rotating the sections of the two-section sleeve, the following angles can be obtained:

Position	Angle
1	0° 0′
2	1° 26′
3	2° 51′
4	4° 17′
5	5° 43′
6	7° 8′
7	8° 34′
8	10° 0′

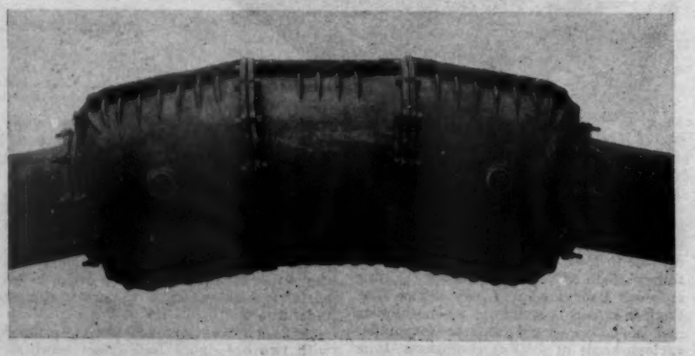
A three-section sleeve may be rotated to produce the following angles:

Position	Angle
1	0° 0′
2	2° 51′
3	5° 43′
4	8° 34′
5	11° 27′
6	14° 17′
7	18° 24′
8	20° 0′

Emergency repairs of field bends may be taken as an example of the unusual or extreme conditions that sometimes arise to tax the resourcefulness of engineers. Under high-pressure operation, a pipe or a joint may require a type of repair for which no particular clamp, sleeve or fitting is exactly suitable no matter how complete or extensive the standard line of repair items may be. Then experienced coupling engineers are called on to devise a special repair appliance that will permit the service to go on without interruption.



Sleeve assembled in two sections, rotated to cover angular bend of 4°17′, for emergency repair of high-pressure natural gas line



Not a Mesozoic dinosaur, but an ingenious new split sleeve, shown assembled in three sections to produce maximum angle of 20°0′

MISSOURI MAY TAX GAS

JEFFERSON CITY, Mo., Mar. 27.—A 1 per cent tax on all gas, electric and water company utilities will be included in the taxable items in Governor Park's new sales tax measure.

GAS FOR CALIFORNIA FARMS

The Gas Fuel Service Co. of Los Angeles has applied to the California Railroad Commission for a certificate to serve farming communities in King and Fresno Counties with natural gas.

Pipe Line to Elba Pool for Michigan Franchises

MOUNT PLEASANT, Mich., Mar. 27. Gas operators appear to be getting busy in Central Michigan. Natural gas franchises were voted to George Miller, trustee, for a company to be set up later, by three Gratiot County villages, Elsie, Perrington and Ashley. Township boards in Bannister, North Star, Pompeii and Middleton have approved similar franchise proposals and these communities will vote April 3. Carson City also may vote on a gas franchise soon. Mr. Miller and his associates hope to secure franchises in several communities in that part of Gratiot County where it is planned to run a pipe line from the Elba Pool. Approval of the State Public Utilities Commission is still to be secured.

Five wells with a combined open flow of about 6,000,000 feet, located in Elba Township, form the basis of supply for the proposed pipe line. None of the wells is yet being used for commercial purposes.

Lines to Sixteen Towns Approved by Iowa Board

BURLINGTON, Iowa, Mar. 27.—Burlington is listed with 15 other cities of southeastern Iowa, to be served with natural gas by the Natural Gas Pipe Line Co. of America, according to dispatches that the company has been given permission by a ruling of the State Railroad Commission following several hearings.

The company is said to have been denied authority to serve Centerville and Albia but is authorized to serve Fairfield, Burlington, Fort Madison, Oskaloosa, Malvern, Clarinda, Osceola, Charlton, Ottumwa, Wapello, Sigourney, Keota, Washington, Iowa City, Cedar Rapids and Keokuk. The firm has headquarters in Chicago.

RATE TESTIMONY RECORD

FORT WORTH, Tex., Mar. 27.—A record in rate case cross-examination was believed to have been set before Texas Railroad Commission examiners inquiring into the fairness of rates charged by the Lone Star Gas Co. at the gates of more than 250 Texas municipalities. E. A. Steinberger, Dallas, chief valuation engineer of the utility company, is completing his testimony after a month and four days on the witness stand. The transcript of the shorthand record of Steinberger's cross-examination fills more than 3,000 typewritten pages.

APPEAL KANSAS CUT

TOPEKA, Kans., Mar. 27.—Eleven Cities Service gas distributing subsidiaries have filed an application with the Kansas Corporation Commission asking it to set aside an order, granted March 10 by the abolished public service commission, under which they were ordered to reduce the price paid by them for main line gas from 40 to 35 cents a thousand feet.

ALABAMA TALKS GAS TAX

Gas interests in Alabama are preparing to co-operate with merchants against two sales tax bills before the legislature. Representative Harrison has introduced a sales tax bill which will place a levy of 2½ cents on natural gas, 1 per cent on manufactured gas sold for industrial purposes and 2 per cent for domestic use. There is a clause which stipulates gas companies shall not pass the tax to consumers. There is some talk of even making the rate 5 per cent.

TECHNICAL QUESTIONS ANSWERED

By Charles K. Francis, Ph. D., Technical Editor

This department of The Oil and Gas Journal is devoted to the manufacturing branches of the oil industry.

Those connected with the refining of crude petroleum, the manufacture of natural gasoline and closely allied industries are invited to submit their problems to Dr. C. K. Francis, technical editor. The department was created for the purpose of aiding managers, superintendents, engineers, chemists and all those engaged in the various phases of plant operation; also those connected with marketing and utilization of petroleum products.

Questions should be submitted in as much detail as possible.

Inquiries must be signed but only the given initials will be printed. The source of the questions is considered to be confidential.

Questions requiring a discussion of patents, the use of intricate formulas, extended computations, or cost estimates cannot be considered.

When the matter is of general interest the reply will be published within a reasonable time.

Naturally Active Bleaching Earth From Carlsbad Carlonite

Have you any information about a filtering earth called carlonite? Would like to know where it is obtained and how it is used? Anything you can give me on this will be appreciated.—G. H. R.

Carlonite is a bleaching earth recently discovered near Carlsbad, Germany, which was described by E. Belani, Petrol. Zeit., Dec. 14, 1932, p. 11. This was abstracted in Library Bulletin of Abstracts, Vol. 8, Jan. 11, 1933, p. 5, from which the following has been arranged:

This mineral has a high content of silicic acid and aluminum compounds so that it is not necessary to activate it by special treatment. It has a high filtering capacity, has no corrosive action and the filtrate is odorless and color stable. The recommended practice in the treatment of petroleum oils is to use carlonite first and then follow with a high grade activated earth.

The Carlsbad earth, "carlonite," is basic in character on account of its calcium and magnesium oxide content. From 40 to 50 per cent of a more expensive highly active bleaching earth can be replaced by carlonite. The following points should be observed in refining lubricating oils with it: The agitators must have flat cones, otherwise too much powder is held in the angle between the shell and the cone. From 3 to 4 per cent of the powder should be used, it should be thoroughly well mixed, and the oil should be cold. Mixing must be continued till all trace of inorganic acids disappears, after which the oil is raised to filtering temperature as quickly as possible. Between 50 and 70° C. (122-158° F.) is the optimum for light oils, and from 70 to 90° C. (194° F.) for heavy. It is an advantage to treat the oils with a somewhat diluted acid. For instance, a favorable concentration for lubricating oils from Grozny petroleum is 88-90 per cent sulphuric acid. If it is desirable to bleach the lubricating oil at the same time that it is refined, it can be done economically by adding 0.5 to 1 per cent of highly active bleaching earth, but all the moisture must be driven out of the activated earth first. If finely ground lime is used to neutralize the oils, say 0.25 per cent, this should be mixed with the cold oil for about 30 minutes before adding 1.5 per cent of carlonite and mixing for 30 minutes longer.

Distillation Process Required for Removing Oil from Gasoline

Can compressor lubricating oil be taken from natural gasoline by filtering it through fuller's earth? Is there any other method of removing this oil from natural gasoline?—R. J. B.

All petroleum lubricating oils are to a large extent soluble in gasoline. Fuller's earth is a filtering medium through which the lighter petroleum products percolate much more rapidly than the heavy oils, but there is no evidence of a selective power strong enough to effect a separation of lubricating oil and gasoline. Any lubricating oil present in the gasoline will pass through the fuller's earth, remaining in solution, the only influence of the earth would be its customary action in reducing the color of the solution.

When extracting gasoline from natural gas by the compression method the gas and gasoline should not come in contact with lubricating oil. The presence of oil in a compression gasoline suggests that the cylinders are in poor condition, permitting some oil to contaminate the gasoline. A gasoline containing lubricating oil will have to be purified in a manner similar to that employed for obtaining gasoline from crude oil; that is, by distillation. Since the operation does not require much heat it is the usual practice to make the distillation in a still of the tower type with steam alone. Sometimes there is enough exhaust steam available to supply all the heat required, but at most only a small quantity of live steam will be required.

High Percentage Antiknock Fuel From East Texas Crude

Kindly furnish us with a complete laboratory analysis of East Texas crude. Would like this to include the yield of gasoline by cracking.—J. F. M.

A complete analyses of East Texas crude oil (Joiner) was published in The Oil and Gas Journal, May 21, 1931. This article, by Egloff, Nelson and Truesdell, shows physical and chemical analyses together with the results of plant tests. These may be summarized as below:

Joiner Crude Oil	
Gravity, A.P.I.	38.9
Sulphur	0.23%
Yield	
Gasoline	37.6%
Gravity	60.4
I.B.P.	96° F.
Endpoint	400° F.
Octane number	64
Kerosene	5.9
Gravity	42.8
Light gas oil	12.0
Gravity	39.0
Presr. dist. botms.	9.7
Coke, lbs./bbl.	65
Cas, cu. ft./bbl.	485
Coke, gas, loss	10.9
Cracked gasoline	23.9
Total gasoline	61.5%
S. R. gasoline	37.6%
Cracked gasoline	23.9%

Yields total 76 per cent gasoline were obtained by topping and cracking. The octane number of the blended gasoline was 64-65; the cracked gasoline ranged from 68 to 71 octane number.

Benzol Blends Not Extensively Used for Motor Fuel

In what proportion is benzol blended with gasoline for use as motor fuel in the United States? What is the selling price for such mixtures at the filling stations? Is the selling price of benzol or the blends governed by the market price of gasoline?—E. H.

About 10 years ago, when the market price of gasoline was much higher than it is today, benzol was blended with gasoline in varying proportions for making antiknock motor fuel; the percentage used in the blend seldom exceeded 40 per cent, although some fuels containing 50 per cent were known. The minimum was approximately 20 per cent. For several years the price obtained for gasoline has not been favorable to the use of benzol in this way.

The production of benzol several years ago exceeded the demand, with the result that the wholesale price was reduced to a figure that gave a good profit when retailed in the form of a gasoline blend, in some favorably located districts. During 1932 the market quotations in large quantity lots, tank car shipments, did not vary much from 20 cents a gallon delivered and it seems conservative to state that no motor fuel benzol was sold last year below 15 cents a gallon. The quantity produced in the United States in 1929 was about 153,000,000 gallons but the available reports indicate that the production for 1932 can be safely estimated to have been less than half this quantity.

The average wholesale price of gasoline, U. S. Motor grade, during the year 1932 was 3.92 cents and the selling price at the filling stations early in January, 1933, ranged from 9½ to 19 cents, exclusive of taxes varying from 3 to 11 cents. Since the tax must be paid on the finished motor fuel any benzol used in this manner would be subjected to the same tax as gasoline. Under the circumstances of a first price much higher than that charged for gasoline and the addition of the tax makes it difficult to market benzol blends at a profit. At the present time there is no relation between the base price for benzol and the amount charged for gasoline.

When benzol was more extensively used for blending with gasoline to produce a good antiknock motor fuel, it was the practice to sell the product at a premium of 2 to 3 cents a gallon above the regular grade of gasoline. An important consideration relating to the use of benzol for motor fuel is that it must meet the national specifications for gasoline with respect to gum, corrosion and sulphur, so the commercial product must be sufficiently pure to meet these requirements. These include the corrosion test, made with a strip of copper or the copper dish, the copper dish gum test, the total sulphur content of not over 0.1 per cent, and the sodium plumbite or doctor test.

Factors Involved in Treatment of Emulsified Crude Oils

We have a clay and system for treating crude, emulsified oil, and other oils and want to know can a system costing say $5,000 be sold to independent well owners if we can show where they can refine at a low cost the crude that is now being rejected? Is there enough of this rejected oil to warrant going after the business, provided we can handle it at low cost?—F. E. L.

Most oil fields encounter water at some stage of the development, some wells always produce water with the oil and the separation of the oil and water may frequently be accomplished by inexpensive and simple methods. In the presence of high pressure gas, heavy mineralized water and a large quantity of oil a serious emulsified condition may result, which will be expensive to correct. The tendency to form emulsions is usually greater in the heavy oil districts and the problem is liable to become more serious with the age of the field.

There are no accurate statistics showing the quantity of emulsified crude oil that has to be treated to bring it to pipe line quality. Probably it will be equivalent to between 10 and 20 per cent of the total production and represent a value amounting to many millions of dollars. A large part of this oil is purified by settling and heating to a slight extent, requiring no special equipment, but in some instances extensive plants are built in which the oil is chemically treated, filtered or even distilled. The electrical dehydration process is extensively used in California. Such plants may vary in cost from a few hundred dollars to many thousands, varying with the quality and quantity of the oil to be treated. There are some processes that do very well for handling a comparatively small volume or when the emulsion is not difficult to break, that cannot be used on a large scale because of the expense.

All of the important producing companies are interested in cheap and efficient methods for treating emulsified crude oil and tank settlings. Some producers will agree to permit an installation to be made on their property, without cost to them, and the treating interests are paid in a percentage of the oil recovered. Any process to be profitable on the present market must require but little expenditure for equipment and materials, per barrel of oil treated. The process should be capable of handling large volumes with high efficiencies at low costs.

It should be noted that there are many different substances that will do some filtering and reduce color. Sand, crushed stone, and charcoal are used in filters. The several clays or mineral earths, used as filtering mediums in the petroleum industry, are valued for their power to reduce color and any material offered for filtering petroleum oils must at least equal the power of good fuller's earth and be delivered at a low cost.

FIELD PROBLEMS FROM READERS

Edited by Thomas F. Smiley

This department is conducted in order that men connected with the drilling, producing or transporting branches of the petroleum industry may obtain aid in solving problems that confront them in their work. Readers are invited to send questions freely. These questions will be placed in the hands of persons capable of answering them authoritatively, and the answers, based on the best available information, will be published.

Each question should give as much detail as possible, especially if it involves depth of sands, types of sands and operations on adjoining or nearby properties. The source of questions will be considered confidential, and only the initials of the sender will be published. Questions involving patented processes, intricate formulas or estimates of cost cannot be answered. If an immediate answer is important, one will be given by mail when the writer requests it.

In this connection, The Oil and Gas Journal will be glad to publish articles from field men who have devised new methods or improved old ones.

Damage to Well Fittings Caused by Sand in Oklahoma Fields

I read a statement recently that sand in some of the following wells in the Oklahoma City Field was brought up with such force that it tore out fittings at the well head. Wells in this district produce from a limestone formation and I never heard of any sand trouble. However, some other men and I are considering a deal that may mean we will do some operating in Oklahoma. For that reason I would like to know more about the danger of sand trouble in that state. Is it general? Is damage done by sand confined to well head fittings? If not, what other damage is likely to occur?—T. Y. T.

The following answer to your questions is provided by Prof. H. C. George, consulting engineer, U. S. Bureau of Mines.

The extent to which sand is troublesome in flowing wells depends upon such factors as the nature of the producing sand, gas pressure, quantity of fluid produced, specific gravity of the oil, presence o absence of water and the size of perforations. Sand troubles in flowing wells are seldom of much importance in "hard sand" fields, even though wells in these fields are usually not cased through the oil sand, but produce from open hole.

Many wells in the Oklahoma City Field, producing from loosely consolidated sand, generally without perforated or screen pipe placed through the producing horizon, bring up large quantities of sand with the high pressure oil and gas. Well fittings in many instances were cut out rapidly, so that special fittings and flow-control devices have been developed. One well in this field when tested flowed at the rate of 2,000,000 feet of gas, 2,100 bbls. of oil and 600 bbls. of sand per hour. In 2 hours and 15 minutes the sand cut through a 4-inch internal diameter flow nipple with seven-eighths inch walls.

Sand may settle in wells until an accumulation of it will reduce the oil production materially. However, while the gas pressure is high and the quantity of fluid produced is large, most of the sand is carried out of the well with the production. As the gas pressure declines the hole may fill up until the production is almost entirely cut off.

Among the serious effects of sand with the oil is its tendency to enlarge the holes in perforated pipe or even rupture portions of screen pipe when it is used. When sand creates openings in perforated or screen pipe large enough to permit the passage of sand in appreciable quantities, the cutting action is swift and it continues until the well sands up and production stops. If the well is flowing without restriction the screen pipe eventually may collapse and the producing formation cave into the well.

Exceptionally large wells may eject sand for a long time even when the screen pipe is seriously damaged. The flow of such wells continues until the gas pressure is insufficient to clean the well. The sand which settles between flow periods in "head wells" is detrimental to production and eventually reduces the oil output even though the screen be in fair condition.

Flowing wells producing from soft, unconsolidated standstone formations often face serious problems. Much trouble has been experienced from sand and high pressure gas in the fields of South Texas, North Louisiana, California and Oklahoma. The sand in these fields in some cases has cut out fittings at the top of the well and even the well casing itself. The cutting action of sand in flowing wells is intensified by high gas pressure. Dry gas wells which make sand cut out their fittings more quickly than oil wells. Collapsed casing and in some cases sheared and sidetracked casing have been found in wells that produced large quantities of sand with the oil.

Seeks Further Information About Unit Plan of Developing Pool

In an article in your issue of May 26, 1932, which I have been reading, you discuss a joint method of oil-pool development by the land owners and describe it as being more fair to them than where each operator looks after his own interests exclusively. You say also that this plan has many other advantages, but you do not go into these in the article mentioned. I am quite interested in this subject and would appreciate it if you could tell me briefly what some of the more important advantages of this method of developing a pool are supposed to be.—E. R. N.

In the first place you are urged to read the articles by Earl Oliver, chairman of the A.I.M.E. unit operation committee, in collaboration with W. P. Z. German, general attorney for the Skelly Oil Co., which appeared in The Oil and Gas Journal. There were six of these articles, on the general subject of "Stabilizing the Petroleum Industry." The first was published July 23, 1931, and the last August 27, 1931. They provide an excellent foundation for further study of unit operation, as the method of pool development referred to in your letter is called. Since publication of the series of articles by Mr. Oliver and Mr. German this periodical has published a series written by Mr. Oliver alone. These discuss various phases of the subject and meet objections which have been offered.

Returning to your specific request for information as to the more important advantages offered by the unit plan of pool development this department is indebted to Mr. Oliver for the following list:

1. Development and operating costs per barrel would be very much less than under the old haphazard method.
2. The frenzied development and overproduction conditions that characterize the discovery of a new pool would be absent.
3. Every owner would be entitled to that proportion of the oil withdrawn daily from the pool that the recoverable content of his bears to the recoverable content of the reservoir.
4. No incentive would exist to force oil on an unwilling market.
5. Oil could be delivered to each owner when and as he needs it instead of compelling him to take it when he does not need it. Properties would be more valuable and more readily salable since the purchaser would know he does not carry the hazard of unreasonable development costs or of losing his oil entirely by migration.
6. Independent operators and royalty owners wishing to turn their property into cash at once would be able to do so under better conditions because these properties would be in demand by the major companies as permanent reserves.
7. Stealing oil would be eliminated because the outlets of the pool would be few and the division of the oil from those outlets would be on a mathematically calculated division order subject to easy supervision.

Why Was It Called That?

DRILL

The word "drill" is derived from the Dutch "drillen," to bore; but of livelier interest is the following description of the drill and its operation found in a discussion of "Boring of Oil Wells" by Dr. Henri Erni, published in 1865, just six years after Drake's discovery: "The Drill is a heavy iron chisel with rounded and sharpened end. It is about 3 feet long and weighs from 70 to 100 pounds. It is worked up and down by means of a rod or rope attached to the upper end. This chisel is followed by a reamer, made like the drill, except the end is square. It breaks down the little irregular juttings of rock left by the drill. The reamer is followed by the sand pump, which cleans out the debris."

Viscosity of Lubricating Oil as Factor in Its Effectiveness

Is it true that scientists have developed a new theory of lubrication to the effect that viscosity of the lubricant has little or nothing to do with its effectiveness? If it is a fact that new ideas have been adopted I would appreciate some explanation of how lubrication is now supposed to be brought about.—E. S. T.

The theory to which you refer is probably the one developed as a result of discoveries of peculiarities in the behavior of lubricants revealed through tests made with a device especially designed for the investigation of lubrication processes. The lubrication engineering committee of the American Society of Mechanical Engineers made a report of its work on this theory in June, 1932.

The practical importance of this theory lies in the novel bases for the evaluation of the lubricating properties of oils and greases and it offers an explanation for matters that have puzzled lubrication engineers.

The theory offers factual support for the discoveries of German investigators to the effect that lubricating properties of oil as such are not determined by the viscosity of the oil. It also offers experimental proof of Langmuir's theory that a layer of lubricant one molecule thick is held by chemical forces at the face of the metal, as well as the theory of French investigators that a comparatively heavy layer of oil is held to the face of the metal by electrical or magnetic fields.

Not only has the actual presence of these layers been confirmed but the lubricant has been found to peel off layer after layer. It has been discovered further that eventually there is reached an "ultimate" layer which does not peel off, even when enormous disruptive forces are applied to it.

Another startling discovery has been that if the ultimate layer is wiped off the face of the metal a new layer of lubricant immediately is created thereon. In the case of a steel lubricated surface, for example, 21 layers of oil have been wiped off where the presence of even a single fluid layer had not been suspected.

With these and certain other facts as a foundation, a new picture of the mechanism of lubrication has been built up. Briefly, according to this theory a layer of oil is formed on the surface of the metal, the thickness and strength characteristics of this layer being determined by the character of the lubricant and the character of the metal. This layer, in turn, pumps up under an enormous pressure of oil into the crevices of the metal. (This is in accord with the most modern conceptions of phenomena of adsorption.) In the course of contact with the bearing surfaces on the journal and the brasses (the same especially applies to ball and roller bearings as well as Kingsbury bearings), the free film plays no part as a means of separating the surfaces of the metal. This is done by the newly discovered powerful adhering layers of lubricant and when, in the course of operation of the bearing, these are wiped off, they are immediately restored by the oil ejected under enormous pressure from the crevices in and under the metal surfaces. The remarkable circumstance is therefore established that any lubrication is essentially high-pressure lubrication. In this mechanism of lubrication entirely new functions are ascribed to the free film of lubricant.

PERSONAL PARAGRAPHS

W. C. Rogers, sales manager, New York Rubber Corporation, New York City, spent last week in Tulsa.

* * *

H. L. Erlicker, of the Vacuum Oil Company, sailed from New York for Nassau, Miami, and Havana.

* * *

J. R. Funk, service representative of the Landis Machine Company, Waynesboro, Pa., was in Tulsa last week.

* * *

Enrique Amada, chief clerk for the West India Oil Company at San Juan, Porto Rico, has been awarded a 20-year service button.

* * *

George G. Buschman, formerly with Sherwood Brothers, Inc., is now affiliated with the Coastwise Petroleum Company of Baltimore, Md.

* * *

R. D. Jordan has resigned as division sales manager at Omaha, Neb., for Skelly Oil Company, being succeeded by L. S. Loudon, his assistant.

* * *

George W. Kirst, auditor for the Atlantic Refining Company, Philadelphia, Pa., is en route to Lisbon, Portugal, on business for the company.

* * *

D. F. Cocks and R. B. Dodson have been elected directors of the Standard Oil Company of Kentucky, succeeding S. W. Soons and A. K. Whitelaw, retired.

* * *

Lewis Barnett, chief clerk in the accounting department of the West India Oil Company at Buenos Aires, has been awarded a 20-year service button.

* * *

John L. Poor, formerly chief chemist of the Altitude Petroleum Corporation, of Tulsa, has joined the Belgo Petroleum Company, of Brussels, Belgium.

* * *

Rodney S. Durkee has been elected a director of the Standard Oil Company of New York, Inc. Mr. Durkee is comptroller of Socony-Vacuum Corporation.

* * *

Ralph Jerome, formerly with J. B. McAnally and Bonded Royalties, Inc., has organized Royalty Engineers, Inc., with offices in the Philcade Building, Tulsa.

* * *

Sir John Cadman, G.C.M.G., chairman of the Anglo-Persian Oil Company, accompanied by William Fraser, C.B.E., the deputy chairman are in Persia.

* * *

E. I. Overton, bulk sales manager for Shell Eastern Petroleum Products, Inc., with headquarters at New York, has returned from an extended West Indies and Central American cruise, during which he visited oil plants at Trinidad and Curacao.

* * *

H. H. MacIntyre, pipe line superintendent of the Anglo-Persian Oil Company in Persia, has retired after 22 years' service with the company, whose staff he joined as one of the engineers selected to supervise the laying of the first pipe line in Persia.

* * *

W. N. Cottrell, purchasing agent for the Standard Oil Company of Louisiana, is receiving congratulations upon the completion of 30 years of service with the Standard Oil Company (New Jersey). He has been awarded a service button. His offices were recently removed from Baton Rouge to New Orleans.

* * *

Hon. Clive Pearson, brother of Lord Cowdray, John Pearson, son of Lord Cowdray; John E. Body of London, and Henry W. Masters, Houston, Tex., representative of S. Pearson & Son, of London, England, were in Tulsa last week, in conference with Vice President A. M. Blow, and officials of the Amerada Petroleum Corporation.

Earl B. Noble, assistant chief geologist of the Union Oil Company of California, is celebrating the arrival of a second son, born in Los Angeles, Calif.

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Richard Airey, president of the Asiatic Petroleum Company (Delaware), Ltd., has been elected vice president of the British Empire Chamber of Commerce in the United States for 1933.

* * *

T. F. Hudgins, vice president in charge of sales, and H. A. Gehres, chief engineer, of the Cooper-Bessemer Corporation, spent some time in the Mid-Continent area and visited the Tulsa office.

Men of the Industry

FRANK R. CLARK

Frank Rinker Clark, newly elected president of the American Association of Petroleum Geologists, was born in Grantsville, Utah, on March 14, 1881. He graduated from the University of Utah, Salt Lake City in 1910 with B.S. degree and joined S. Pearson & Son, Ltd., that year as geologist. He was detailed to Mexico and remained there for a year.

In 1911 Mr. Clark joined the U. S. Geological Survey and remained in that service until 1919. He was one of the members of the land classification board during the years 1914-16 and wrote several professional papers and bulletins. These bulletins dealt mostly with coal in Ohio and Utah. Bulletin 686(i) was on the "Structure and Oil and Gas Resources of Osage Reservation."

From 1919 to 1923 Mr. Clark was chief geologist for the Petroleum Exploration Company and Wiser Oil Company with headquarters at Sistersville, W. Va. His work during that time was mostly in West Virginia and Montana.

Since 1923 Mr. Clark has been with the Mid-Kansas Oil & Gas Company and is now chief geologist for that company with headquarters in Tulsa.

Mr. Clark is a fellow of the Geological Society of America, and a member of the American Institute of Mining and Metallurgical Engineers, and the Tulsa Geological Society. His work has been specialized in stratigraphy and geology of fuels.

In 1910 he married Miss Theresa Burton of Salt Lake City and they have three children, Frank, Jr., Virginia and Rosalon.

Fred E. Cooper, Tulsa, of the Allis-Chalmers-Rumely Company, has been visiting Titusville, Pa.

* * *

James W. McGuire, service station supervisor for the Colonial Beacon Oil Company, Binghamton, N. Y., has been awarded a 10-year service button.

* * *

Herman F. Heep, Houston, Tex., independent operator and president of the Heep Oil Corporation, spent two weeks on a pleasure trip to Mexico City, Mexico.

* * *

Herbert A. Davis, of the sales department of the Standard Oil Company of California, was guest of honor at a banquet before retiring after 30 years of continuous service.

* * *

Walter S. McLucas, chairman of the Commerce Trust Company, Kansas City, Mo., has been elected director of the Southland Royalty Company, succeeding the late John Markham.

* * *

L. Sonneborn Sons, Inc., refiners and distributors of special petroleum products, have appointed Harry Cohen of Atlanta, Ga., sales representative in Georgia, Florida and Alabama for white mineral oils.

* * *

Bernard Lewis, of the Pittsburgh Experiment Station, U. S. Bureau of Mines, addressed the Sharon, Pa., section of the American Institute of Electrical Engineers on "Explosions, Flames and Their Propagation."

* * *

J. C. Long, who is manager of publications and director of advertising for the Bethlehem Steel Corporation, has written a life of Lord Jeffrey Amherst, which has been published by Macmillan & Company.

* * *

Frank W. Lane, formerly a member of the research staff of The Dorr Company, Inc., at Westport, Conn., is now working on research for the Krebs Pigment & Color Corporation, at its plant at Newport, Del.

* * *

Ken R. Dyke, advertising and sales promotion manager of the Johns-Manville Sales Corporation, New York, has been appointed executive vice president in charge of sales promotion and merchandising activities.

* * *

E. R. Rich, vice president of the General Petroleum Corporation, and a director of the Standard Oil Company of New York, will retire from active service at the end of the current month, after spending 42 years in the service of Socony and including 20 years in India. Including the time and a half allowance for foreign service, Mr. Rich's service record shows a total of 51 years.

* * *

Waverly F. Melton has been appointed substation examiner for the eastern branch of the Standard Oil Company of Pennsylvania. He has been with the New Jersey organization since 1921, his first post being at Havana with the West India Oil Company, being transferred to the Standard Oil Company of Brazil in 1926, and returning in 1931, to join the Standard Oil Company of Pennsylvania.

* * *

A. Bruce Boehm, formerly lubrication assistant for the Baltimore branch of the Standard Oil Company of New Jersey, has been placed in charge of lubrication sales for the Colonial-Beacon Oil Company, with headquarters at Boston, Mass. R. J. Fahl, lubrication assistant at the Richmond branch of the Standard Oil Company of New Jersey for three years, has been transferred to Baltimore, succeeding Mr. Boehm. A. E. Lee, of the New Jersey branch, succeeds Mr. Fahl at Richmond. Mr. Lee was formerly lubrication engineer for the company at Charleston, W. Va.

MARKET RECORD OF OIL SECURITIES

By A. E. Mockler

NEW YORK, Mar. 27.—Gross operating income of $60,711,495 for the past year is shown in the annual report of Pure Oil Co. made by President Henry M. Dawes. This is an increase of $3,874,000 over the previous year. Net earnings before interest, depreciation and depletion were $9,118,014, compared with $8,635,661. The company reduced its funded debt $2,000,000. Interest paid on funded debt amounted to $2,184,851. Notes payable were reduced by $532,748. The sum of $642,386 was carried to surplus after payment of fixed charges but before preferred dividend payments. Cash dividends on the preferred of $2,057,585 were paid, partly from surplus. Equitities in incomes of affiliates totaling $706,925 helped to offset this. Of the current assets totaling $24,718,661, cash amounted to $5,648,162, while current liabilities totaled $11,852,349. Attention was called by President Dawes to the tax burden of the industry. The company's gasoline tax total amounted to $20,000,000.

Tide Water

Tide Water Associated Oil Co., which omitted its regular dividend of $1.50 a share in its 6 per cent cumulative preferred stock, reported a sharp improvement in earnings for the past year. The company earned last year consolidated net profit of $4,718,694 after depreciation, depletion, interest, taxes, minority interests and other charges, equal after preferred dividends to 13 cents per share on the 5,611,040 shares of common stock outstanding at the close of the year. This was a substantial improvement over 1931, which showed a net loss of $5,818,671.

Tide Water Oil Co. earned net profit of $2,172,181 last year, after all charges and reserves, equal after preferred dividend requirements to 54 cents a share on the 2,190,323 no-par shares of common stock. This compared with a net loss of $4,521,726 in 1931.

Associated Oil Co. earned net profit of $3,434,727 in 1932 after all charges and reserves, equal to $1.50 a share on the 2,290,412 shares outstanding. This compared with a loss of $981,764 by this company in the previous year.

Standard Oil of Ohio

Standard Oil Co. of Ohio has omitted the dividend on the common stock usually paid at this time. In each of the preceding two quarters, 37½ cents was paid on the common stock, prior to which the stock was on a $2.50 basis. The regular quarterly dividend of $1.25 per share on the 5 per cent preferred was declared, payable April 15 to stock of record March 31.

Gulf Oil

Gulf Oil Corp. and subsidiaries report for the year ended December 31, 1932, net profit of $2,743,492 after taxes, depreciation, depletion, interest, etc. This compares with net loss of $23,670,052 in 1931, after taxes, depreciation, depletion, etc., and an adjustment of $11,958,086 in oil inventories.

Pan American

Pan American Petroleum & Transport Co. has notified the New York Stock Exchange that it will simplify its capital structure through the creation of a single class of common stock, in place of its "A" and "B" common stocks now listed. The company proposes to change its authorized capital stock from $25,000,000 par value preferred stock, 1,100,000 shares of $5 par value common and 2,000,000 shares of class "B" common, par value $5, to 5,000,000 shares of new common, par value $5 a share. Under the reorganization plan, each present share of common and class "B" common will be exchangeable for one share of the new common stock.

Barnsdall

Barnsdall Corp. and subsidiaries report for the year ended December 31, 1932, net loss of $847,072, after interest, taxes, depreciation, intangible development costs, etc., as compared with net loss of $3,268,637 in 1931. Current assets as of December 31, 1932, including $801,684 cash, amounted to $7,251,940 and current liabilities were $4,336,291, against cash of $915,024 current assets of $7,504,749 and current liabilities of $3,812,410 at the close of the previous year.

Twenty Representative Stocks

The Oil and Gas Journal's weekly average price of 20 representative petroleum stocks listed on the New York Stock Exchange and New York Curb, based on closing quotations for Wednesday, was as follows:

Sept. 7	18.50	Dec. 14	14.21
Sept. 14	15.90	Dec. 21	13.53
Sept. 21	16.72	Dec. 28	13.50
Sept. 28	15.55	Jan. 4	13.89
Oct. 5	14.44	Jan. 11	14.52
Oct. 11	14.31	Jan. 18	13.76
Oct. 19	14.37	Jan. 25	13.37
Oct. 26	14.43	Feb. 2	13.26
Nov. 2	13.99	Feb. 8	13.21
Nov. 9	14.36	Feb. 15	13.14
Nov. 16	15.15	Feb. 21	13.14
Nov. 23	14.61	Mar. 1	11.91
Nov. 30	14.04	Mar. 15	14.22
Dec. 7	13.31	Mar. 22	12.66

Seaboard

Seaboard Oil Co. of Delaware and subsidiaries report for 1932 net profit of $858,172 after depreciation, depletion, intangible development costs, property abandonments, lease amortizations and reserves for contingencies, equal to 71 cents a share on 1,204,460 shares of capital stock, excluding 39,923 shares held in the treasury. This compares with net profit of $123,711, or 10 cents a share, on 1,198,360 shares in 1931. Con-

Independent Oils on New York Curb

Quotations Compiled by Francis, Bro. & Co., Associate Members of New York Curb, Kennedy Building, Tulsa, Okla.

(Complete record week ended March 18)

1933 High	1933 Low	Week ended Mar. 18 Sales	Week ended Mar. 18 High	Week ended Mar. 18 Low	Close Mar. 22	Stocks—		Outstanding capital	Par value	Div. rate	Payable or last paid	1930 High	1930 Low	1931 High	1931 Low	1932 High	1932 Low
⅜	¼	300	¼	¼	..	American Maracaibo	(sh)	700,000	N.P.	....	.....	4½	½	1¾	¼	¾	¼
1⅞	1⅛	1,300	1⅞	1⅛	..	Arkansas Natural Gas	(sh)	4,084,225	N.P.	....	.....	16¾	4⅝	6½	1⅞	3⅝	⅝
2	1	9,500	2	1⅛	1⅝	Arkansas Natural Gas "A"	(sh)	3,522,521	N.P.	....	.....	16⅝	4⅝	6⅝	1⅞	3⅜	½
3¼	2	500	2⅝	2½	..	Arkansas Natural Gas pfd.	(sh)	2,193,000	$10	....	4- 1-32	8⅛	6¼	7	3⅞	5⅝	1½
7⅝	6⅛	No sales	..	..	..	British American Oil Corp.	(sh)	2,622,642	N.P.	20cQ	3-14-33	23	13⅜	16⅞	6¼	9¾	6¾
⅝	¼	No sales	..	..	..	Carib Syndicate		$131,250	25c	....	.....	2¾	⅝	2⅜	¼	⅝	¼
3½	2	104,500	3½	2⅜	2⅝	Cities Service	(sh)	36,979,065	N.P.	....	6- 1-32	44¼	13	20⅜	5	6⅞	1¼
17½	10½	1,400	16⅜	12¼	12½	Cities Service pfd.	(sh)	1,125,931	N.P.	....	6- 1-31	93⅞	78¼	84¾	35⅝	53⅜	10
⅛	⅛	No sales	..	..	..	Colombia Syndicate		3,250,000	N.P.	....	.....	21	3⅜	7⅛	1	¼	⅛
1¼	⅝	900	1¼	1	..	Columbia Oil & Gasoline v.t.c.	(sh)	$2,000,000	$1	....	.....	⅝	⅛	½	⅛	2⅛	½
½	⅛	No sales	..	..	..	Colon Oil	(sh)	2,200,000	N.P.	....	.....	8¼	1⅛	3½	¼	1¼	¼
1¼	1	No sales	..	..	..	Consolidated Royalty Oil Co.		$5,527,880	$10	5cQ	1-25-33	5⅞	2	2¾	1	2	1
2	⅞	200	2	1⅛	..	Cosden Oil	(sh)	323,950	N.P.	....	.....	74⅜	1¼	3¾	⅜	2⅞	⅛
3⅛	2⅛	200	3	3	..	Darby Petroleum	(sh)	609,696	N.P.	....	10-15-30	21¾	4¼	5	1¾	7⅛	1⅝
1¼	⅞	200	1¼	⅞	1	Derby Oil & Refining	(sh)	500,000	N.P.	....	.....	11	2	6	1½	3	1
..	..	No sales	..	..	..	Derby Oil & Refining pfd.		48,500	N.P.	....	.....	60	30	40⅛	25	24½	10½
31	24	7,400	31	26	28	Gulf Oil Corp.	(sh)	4,504,921	$25	....	10- 1-31	166⅞	58½	75½	25⅜	44¾	23
1½	1¼	No sales	..	..	..	Indian Terr. Illum. Oil "B"	(sh)	7,090,037	N.P.	....	.....	53½	12⅝	16⅞	5	4½	1½
⅛	⅛	1,800	⅛	⅛	..	Intercontinental Petroleum		$5,682,000	$5	....	.....	1¾	⅜	⅝	⅛	¼	⅛
1	⅝	1,100	1	1	..	Kirby Petroleum	(sh)	750,000	N.P.	10c	4-15-33	3	⅞	1⅞	¼	1	⅝
⅛	⅛	No sales	..	..	..	Leonard Oil & Development		$50,000,000	$25	....	.....	5	¾	2	½	¾	⅛
⅞	⅝	700	⅞	¾	..	La. Land & Exp.	(sh)	3,000,000	N.P.	....	.....	4⅜	½	1½	¼	2½	½
2¼	1½	No sales	..	..	..	Lion Oil & Refining	(sh)	250,000	N.P.	....	10-27-30	29	4⅞	6¾	1½	3½	⅞
7⅝	5	1,900	7	6⅛	6	Lone Star Gas	(sh)	5,000,000	N.P.	16cQ‡	3-31-33	55⅞	19⅝	25	5½	11	3⅝
6½	4	No sales	..	..	..	Margay Oil Corp.		160,000	N.P.	25cQ	1-10-33	16	⅜	5	1⅞	8	3⅜
4⅞	2⅛	2,700	4⅞	2⅞	4¼	Memphis Natural Gas	(sh)	920,000	N.P.	....	4-15-32	22¼	7½	12⅛	4½	5¼	1⅝
2	2	No sales	..	..	..	Mexico-Ohio Oil Co.		500,000	N.P.	....	.....	7½	1¾	4⅞	1½	3⅜	1½
⅛	⅛	No sales	..	..	..	Mountain & Gulf		$4,000,000	$1	....	4-15-31	⅝	⅜	½	⅛	⅜	⅛
3⅜	2½	600	3¼	2⅜	..	Mountain Producers		$1,682,182	$10	20cQ	4- 1-33	12⅛	3¾	5⅞	2	4⅜	2⅛
13¼	10	900	12⅝	10½	11¾	National Fuel Gas	(sh)	3,810,183	N.P.	25cQ	1-16-33	41⅜	19⅜	26½	9¾	14⅝	8
⅞	½	No sales	..	..	⅞	New Bradford Oil		$7,224,186	$5	....	4-15-31	3½	1⅛	1½	½	⅞	⅜
⅞	½	No sales	..	..	..	New Mexico and Arizona		$1,000,000	$1	....	.....	7¼	1½	3	¾	1¼	⅝
¾	⅝	No sales	..	..	..	North Central Texas	(sh)	262,446	$5	....	9- 2-30	11¼	2⅛	3¼	⅝	1½	⅝
⅝	⅛	No sales	..	..	..	North European Oil	(sh)	1,372,391	N.P.	....	.....	6¼	⅝	2⅛	¼	⅜	⅛
..	..	No sales	..	..	..	Pacific Western Oil	(sh)	1,000,000	N.P.	....	.....	19½	5½	15	2⅞	8	3
⅛	⅛	No sales	..	..	..	Pantepec Oil	(sh)	1,595,500	N.P.	....	.....	4⅝	⅞	2	⅜	⅝	⅛
..	..	No sales	..	..	..	Reiter-Foster	(sh)	388,584	N.P.	....	12- 2-29	5⅜	1	3⅛	¼	½	⅛
¼	¼	No sales	..	..	..	Richfield Oil pfd. x.w.	(sh)	399,950	$25	....	.....	23½	6½	11	⅛	1	⅛
1	⅝	1,100	1	⅝	..	Ryan Consolidated	(sh)	296,931	N.P.	....	.....	8⅝	2	3	¾	2⅛	⅝
½	⅜	500	⅝	⅜	⅜	Salt Creek Consolidated	(sh)	1,286,300	$10	....	4- 1-31	2½	½	1⅜	⅛	⅞	⅛
4½	3½	1,100	4⅛	3⅛	4⅛	Salt Creek Producers	(sh)	1,496,859	$10	25c	2- 1-33	15¼	5¼	7⅜	2¾	5½	2⅞
⅝	¼	No sales	..	..	..	Sunray Oil	(sh)	1,163,185	$5	....	4-15-31	10	2	5¼	¼	⅝	¼
8	6⅝	200	7⅜	7¼	..	Texon Oil & Land	(sh)	936,036	N.P.	25cf	12-30-32	19½	8	12⅞	2½	10½	4½
½	⅛	100	⅛	⅛	..	Venezuelan Petroleum	(sh)	755,090	$5	....	2-15-30	4¼	⅜	1⅞	¼	⅛	⅛
2¼	1½	No sales	..	..	..	Woodley Petroleum		$500,000	$1	....	3-31-29	5	½	3½	1⅛	2⅜	1⅛

*Ex-dividend. †Plus extra dividend of 25 cents. ‡Payable in stock. §Paid in lieu of regular cash dividend of 2 per cent.

solidated balance sheet as of December 31 shows current assets of $2,308,380, including $1,913,555 in cash and marketable securities. Current liabilities at the end of 1932 amounted to $204,799.

Humble Oil & Refining

Humble Oil & Refining Co. has declared the regular quarterly dividend of 50 cents per share, payable April 1 to stock of record March 2.

California Petrolem

California Petrolem Corp. and subsidiaries (controlled by The Texas Company) reports for 1932 net loss of $2,360,966 after taxes, intangible development costs, depreciation, depletion, interest, etc., compared with net loss of $712,048 in 1931.

Skelly

Skelly Oil Co. reports for 1932 net loss of $674,507, compared with a loss of $2,117,110 for 1930. Gross operating income was $17,963,370, against $18,161,519 in the previous year. Net working capital on December 31, was $8,059,962, an increase of $449,269, and the ratio of current assets to current liabilities was 5.4 to 1, against 4.6 a year previous.

Standard Oil Stocks on New York Curb

Quotations Compiled by Francis, Bro. & Co., Associate Members of New York Curb, Kennedy Building, Tulsa, Okla.

(Complete record week ended March 18)

1932 High	1932 Low	Week ended Mar. 18 Sales	Week ended Mar. 18 High	Week ended Mar. 18 Low	Close Mar. 22	Stocks—		Outstanding capital	Par value	Div. rate	Payable or last paid	1930 High	1930 Low	1931 High	1931 Low	1932 High	1932 Low
6	6	50	6	6	..	Borne Scrymser		$1,000,000	$25	....	10-15-30	25	11¼	16	6	7	6
27	25	No sales	..	..	..	Buckeye Pipe Line		$10,000,000	$50	75cQ	3-15-33	69	39⅞	56	30	35	17½
90	85	50	90	90	87	Chesebrough Mfg.		$3,000,000	$25	$1Q‡	3-31-33	184⅞	104¼	129½	75	90	53
2⅞	2½	1,800	2¾	2½	2½	Creole Petroleum	(sh)	5,977,872	N.P.	....	.....	7⅞	3	3⅞	1⅝	3⅛	1¾
28½	20	350	26¼	24	24½	Eureka Pipe Line		$5,000,000	$100	$1Q	2- 1-33	54¾	26	36	19	35	18
45	40	1,300	44¾	41	42	Humble Oil & Refining		$74,103,300	$25	50cQ	4- 1-33	119	57¼	72	44¼	55	35⅝
8¼	6½	3,100	7⅝	6¾	..	Imperial Oil of Canada	(sh)	26,557,496	N.P.	12½cQ	3- 1-33	30	15	18¼	7⅜	10⅞	6¼
4	3½	No sales	..	..	..	Indiana Pipe Line		$3,000,000	$10	15cS.A.	5-15-33	41	14½	21⅛	5½	7½	2⅜
10⅞	8⅞	7,800	10⅛	9½	9¼	International Petroleum	(sh)	14,247,088	N.P.	25cQ	3-15-33	24	11⅜	15½	7⅜	12¼	8
7⅝	5¾	200	6	5¾	..	National Transit		$6,362,500	$12.50	20cQ	12-15-32	22¾	11½	17½	5	10½	6
3¾	3	No sales	..	..	..	New York Transit	(sh)	500,000	$5	15cQ	4-15-33	21⅜	10⅛	14½	5⅞	6	2⅛
5⅞	5	100	5⅛	5⅛	5	Northern Pipe Line		$1,200,000	$10	25c	3-31-33	54	26¼	35½	20	5½	3⅛
12	11	No sales	..	..	..	South Penn Oil		$30,000,000	$25	25cQ	3-31-33	45⅞	16⅛	23⅞	9¼	16½	9⅝
3½	3	100	3¼	3¼	..	Southern Pipe Line		$1,000,000	$10	10cQ	3- 1-33	20⅞	8⅜	17	7	10	3⅝
33	24½	No sales	..	..	..	Southwest Pennsylvania Pipe Line		$1,750,000	$50	$1Q	12-31-32	64	32	42½	25	37	27
22⅛	17	33,800	19¼	17⅝	18⅜	Standard Oil of Indiana		$424,914,895	$25	25cQ	3- 1-33	59⅞	30	38½	13½	25⅛	13⅛
11⅝	8⅜	4,000	11⅝	10	10⅛	Standard Oil of Kentucky		$26,069,830	$10	25cQ	3-31-33	40½	18⅝	23⅝	12½	15⅞	8⅞
14¼	13¾	No sales	..	..	12½	Standard Oil of Nebraska		$4,770,550	$25	25cQ	3-20-33	48⅞	34⅝	36½	16	19	10¼
21	15½	1,900	19	16¾	16	Standard Oil of Ohio		$18,811,675	$25	37½cQ	1- 3-33	108½	43¼	62½	23	30⅛	15½
1	1	No sales	..	..	..	Swan-Finch Co.	(sh)	34,480	$25	....	1-15-29	10	4	4½	1	2	1⅝

*Ex-dividend. †Unit of trading less than 100 shares. ‡Plus $1 extra.

Transactions in Oil Shares on New York Stock Exchange

Quotations Compiled by Francis, Bro. & Co., Members of the New York Stock Exchange and Associate Members of New York Curb, Kennedy Building, Tulsa, Okla

(Complete record week ended March 18)

1932 High	1932 Low	Week ended Mar. 18 Sales	Week ended Mar. 18 High	Week ended Mar. 18 Low	Close Mar. 22	Stocks—		Outstanding capital	Par value	Div. rate	Payable or last paid	1930 High	1930 Low	1931 High	1931 Low	1932 High	1932 Low
22⅛	18½	3,800	22⅛	21	21½	Amerada Corp.	(sh)	844,200	N.P.	50cQ	1-31-33	31½	16½	23	11¼	22¾	12
16	14	No sales	..	..	..	Associated Oil		$34,356,180	$15	25cQ	.....	51	30	31	8¾	16½	6½
17¼	12⅜	16,400	16½	15¼	15	Atlantic Refining		$67,416,050	$25	25cQ	3-15-33	51⅜	16⅝	23⅝	8⅝	21⅞	8⅝
4¼	3	13,900	4¼	3½	3⅝	Barnsdall Corp.		$11,293,895	$5	....	5-11-31	34	8⅝	14½	4	7	3⅝
17¾	10¼	48,900	13⅞	12⅛	11¼	Columbia Gas & El.	(sh)	11,684,220	N.P.	25cQ§	2-15-33	87	30⅝	45⅝	11⅝	21	4¼
12	10½	100	11	11	..	Colonial Beacon Oil	(sh)	1,444,970	N.P.	....	12-22-22	20⅜	8⅜	10½	7½	12½	9
6¼	5	44,700	6¼	5⅜	5¼	Consolidated Oil Corp.	(sh)	14,218,835	N.P.	....	.....	..	..	..	..	9	4
6⅜	4⅞	21,300	6⅜	5¾	5⅝	Continental Oil of Delaware	(sh)	4,738,594	N.P.	....	12-15-27	30½	7¾	12	5	9⅜	3⅝
20⅝	13¾	38,100	20⅝	16	17¾	General American Tank Car	(sh)	751,638	N.P.	25cQ	1- 2-33	111⅞	53⅛	73⅛	28	35¾	9½
7⅞	4⅝	2,000	7⅞	6	5	General Asphalt	(sh)	413,333	N.P.	....	6-15-32	71½	22⅝	47	9⅝	15½	4¾
15¾	8¼	2,700	13½	10	..	Houston Oil		$24,968,600	$100	....	10-17-30	116⅞	29¼	68½	15¾	28¼	8¾
2	1¼	No sales	..	..	..	Indian Refining		$12,564,070	$10	....	10- 1-30	17	2	4⅝	1⅛	2⅜	1
1	⅝	No sales	..	..	..	Louisiana Oil Refining	(sh)	1,309,069	N.P.	....	.....	12	3½	4½	1	2¼	½
¾	½	200	¾	¾	..	Maracaibo Oil	(sh)	330,000	N.P.	....	.....	10⅜	1⅜	3¾	½	1½	⅜
5⅜	3¾	9,100	5⅜	4½	4	Mid-Continent Petroleum	(sh)	1,857,912	N.P.	....	2-16-31	32	11	16¾	5	8⅞	3¾
6½	5¼	300	6½	6	..	National Supply of Delaware	(sh)	390,879	$50	....	5-15-31	124¾	60	70¼	5	13	3½
7⅛	4¾	55,700	6¼	5⅜	5¼	Ohio Oil	(sh)	6,648,052	N.P.	....	12-15-32	32	16	19½	5⅛	11	5
12½	12	100	12	12	..	Pan American P. & T.	(sh)	1,000,000	$5	10cQ	3-15-33	46½	42	35⅛	20	14	6
12½	11½	200	12	12	..	Pan American P. & T. "B"	(sh)	2,474,288	$5	10cQ	3-15-33	67¼	30	36½	18	14½	7¾
1⅛	½	200	1	1	..	Panhandle P. & R.	(sh)	199,370	N.P.	....	.....	12¾	1¾	4¼	⅝	1¼	¼
6½	4¾	16,500	6½	5⅝	5⅞	Phillips Petroleum	(sh)	4,156,908	N.P.	....	1- 2-31	44⅝	11½	16⅝	4	8⅛	2
⅜	¼	400	⅜	¼	..	Pierce Oil Corp.		$29,622,831	$25	....	.....	2½	½	1½	¼	⅜	¼
1	⅝	2,200	1	⅞	..	Pierce Petroleum	(sh)	2,500,000	N.P.	....	2-16-31	7⅛	1⅛	3⅜	½	1⅝	½
9½	6¾	2,000	9	7¾	7	Plymouth Oil Co.	(sh)	1,050,000	$5	75cA	.....	..	..	..	..	12¼	8½
6	6	No sales	..	..	..	Prairie Oil & Gas		$61,035,800	$25	....	3-31-31	54	11¼	20⅜	4⅛	9½	3½
8⅛	7¼	No sales	..	..	7⅛	Prairie Pipe Line		$101,250,000	$25	....	6-30-31	60	16⅝	26½	5⅞	12¼	5½
⅜	¼	No sales	..	..	..	Producers & Refiners		$37,438,950	$50	..	9-15-23	11⅞	1	6	1	1⅝	⅛
5	3	No sales	..	..	..	Producers & Refiners pfd.		$2,845,350	$50	....	5- 4-25	40	11½	16	3	9¾	1
3⅞	2½	6,600	3¾	3¼	3¼	Pure Oil		$75,959,250	$25	....	9- 1-30	27¼	7⅝	11⅞	3¼	6½	2⅞
½	¼	600	½	⅜	..	Richfield Oil (new)		$52,410,875	N.P.	....	.....	9¾	4⅛	6⅜	⅜	1⅝	¼
21⅝	17⅝	4,100	20	18⅞	18⅝	Royal Dutch N. Y.	(sh)	611,303	....	80½cf†	8- 5-32	56½	36⅞	42⅝	13	23¾	12⅛
20¼	15	11,000	19½	17	17¾	Seaboard Oil of Delaware	(sh)	1,204,460	$4	10cQ	12-15-32	37	9¾	20¾	5½	20⅝	6⅝
18	13	10	13	13	..	Shell Transport & Trading Co.		£23,985,000	£1	53cf†	7-22-32	48⅜	26	34	5	16⅜	8
5⅝	4	7,000	5	4¼	4⅝	Shell Union Oil	(sh)	13,066,497	N.P.	....	6-30-30	25½	5¼	10¼	2½	8⅜	2½
44½	30	100	33⅞	33⅞	..	Shell Union Oil pfd.	(sh)	400,000	$100	....	7- 1-31	106¼	55	78	15	65¼	18
6¼	4⅞	600	5½	5	..	Simms Petroleum	(sh)	600,000	$20	25cQ	1-16-32	37	5⅝	11	3½	7½	3¼
3⅜	3	300	3½	3⅜	..	Skelly Oil		$27,441,250	$25	....	12-15-30	12	10⅛	12⅞	2	5⅜	2½
25½	22	200	25	24	26¾	Skelly Oil pfd.	(sh)	119,800	$100	....	5- 1-31	99¾	42	62	10	33½	12
7⅞	6⅛	50,800	7⅜	6⅝	6⅛	Socony-Vacuum		$793,613,588	$25	10cQ	3-15-33	106⅜	98	106	87⅛	12¼	5⅛
101	92½	700	96	92½	..	Standard Oil Export pfd.	(sh)	764,885	$100	$2.50SA.	12-31-32	..	..	21	8⅜	100½	81
26	19½	30,700	24¼	21¾	23	Standard Oil of California	(sh)	13,102,900	N.P.	50cQ	3-15-33	75	42½	51⅜	23⅛	31⅞	15½
17⅝	15	100	15	15	14	Standard Oil of Kansas		$8,000,000	$25	....	3-16-31	49	14⅜	19	7¾	16½	7
31⅜	22¾	66,700	27¾	25⅜	25⅞	Standard Oil of New Jersey		$637,961,700	$25	25cQ	3-15-33	84⅞	32½	52½	26	37⅜	19⅞
37	35	400	36	35½	36	Sun Oil	(sh)	1,531,422	N.P.	25cQ	3-15-33	70	39	45¼	26¾	39⅞	24⅜
1¾	¾	2,000	1½	1⅜	..	Superior Oil Corp.	(sh)	749,979	N.P.	..	12-20-30	9⅜	¾	1⅜	¼	2	¼
14⅛	10¾	22,100	14	12⅝	12¾	The Texas Corporation		$246,204,900	$25	25cQ	4- 1-33	60½	28¼	36¼	9⅛	18¼	9¼
1⅞	1⅝	900	1¾	1⅝	..	Texas Pacific Coal & Oil Co.		$9,304,890	$10	....	12-31-29	14½	4	6½	1⅞	4	1½
..	..	No sales	..	..	..	Tide Water Oil	(sh)	2,190,323	N.P.	....	12-31-32	31	13	18	9⅞	10	5
50	45	200	50	50	..	Tide Water Oil pfd.	(sh)	199,446	N.P.	....	2-15-33	94⅞	71	83	30	62	30
4	3⅛	7,600	3⅞	3⅜	3⅝	Tide Water Associated	(sh)	5,611,040	N.P.	....	2-16-31	17¾	5⅞	9	2⅛	5⅝	2
44⅛	27	600	32⅛	27	27	Tide Water Associated pfd.		$73,284,500	....	....	1- 1-33	89¾	55	68	20½	60	20
11⅝	8½	1,500	11	10¼	10⅝	Union Oil of California		$109,651,750	$25	25cQ	2-10-33	50	10⅛	26⅝	11	15⅜	8
12⅞	10½	2,700	12¼	11½	..	Union Tank Car	(sh)	1,254,048	N.P.	35cQ	3- 1-33	38½	23	25⅛	16	19¼	11¾
1½	¾	300	1⅛	⅞	..	Warner-Quinlan	(sh)	632,948	N.P.	....	7- 1-30	27	4¼	7⅜	⅞	2¼	½
3	2	900	3	2½	2½	Wilcox Oil & Gas	(sh)	428,967	$5	...	5-10-28	21	6½	9⅜	2¾	8¾	2¾

*Ex-dividend. †Interim dividend for 1931. §Payable in 5% convertible preferred stock. A—Paid this year; no regular rate.

In comparing highs and lows for the several years in the three tables, it will be necessary to take into consideration cases where there have been stock split-ups.

Oklahoma-Kansas and Eastern Monthly Pipe Line Report

OKLAHOMA-KANSAS PIPE LINE STATEMENT FOR JANUARY

Runs

Company—	Month (bbls.)	Dy. av. (bbls.)
Gulf Pipe Line Co.	1,327,622	42,829
Texas P. L. Co.	586,271	18,976
Empire P. L. Co.	1,742,169	56,221
Magnolia P. L. Co.	1,177,611	37,986
Cosden P. L. Co.	475,378	15,335
Stanolind P. L. Co.*	2,511,000	81,000
Oklahoma P. L. Co.	1,851,286	59,719
Other lines*	5,678,642	183,182
Total January	15,352,055	495,260
Total December	14,414,968	464,999
Difference	923,087	30,261

Shipments

Gulf P. L. Co.	1,125,537	36,308
Texas P. L. Co.	784,444	25,305
Empire P. L. Co.	1,117,324	36,042
Magnolia P. L. Co.	1,228,705	39,958
Cosden P. L. Co.	540,928	17,449
Stanolind P. L. Co.	3,462,781	111,701
Oklahoma P. L. Co.	1,848,664	59,634
Other lines	5,549,000	179,000
Total January	15,667,390	505,398
Total December	16,266,785	524,735
Difference	599,395	19,337

Stocks

Prairie O. & G. Co.*	33,000,000
Gulf P. L. and Gypsy Oil Co.	6,501,274
The Texas Company	5,603,736
Empire P. L. Co.	5,012,981
Mid-Continent Petroleum Corp.	2,225,473
Stanolind Crude Oil Pur Co.*	14,500,000
Magnolia Petroleum Co.	7,502,705
Oklahoma P. L. Co.	1,196,326
Carter Oil Co.	3,235,197
Other lines	16,823,000
Total January	93,606,692
Total December	93,248,115
Difference	360,577

*Estimated. Stanolind Pipe Line Co. shipments include Texas crude oil.

EASTERN PIPE LINE REPORT FOR MONTH OF FEBRUARY

Runs From Wells

In the following table will be found the regular receipts from wells by various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky, Illinois, Indiana and Michigan for January and February:

	Jan., 1933	Feb., 1933
Nat. Transit	219,447.38	182,312.95
S. W. Pa. P. L.	59,106.41	53,633.73
Eureka P. L.	232,631.15	206,913.51
Buckeye P. L. (Macksburg)	221,724.49	203,874.92
Buckeye P. L. (Cleveland)	9,792.91	8,716.59
Buckeye P. L. (Lima, etc.)	77,464.09	57,981.09
Indiana P. L.	1,000.75	1,355.84
Stoll Oil Ref.	23,390.97	16,008.97
Bradford Trans.	277,801.00	241,197.34
Ashland Ref.	123,573.81	.....
N. Y. Transit	31,244.16	28,563.51
Tide Water P. L.	24,631.65	20,970.06
Pure Oil	384,453.24	362,122.75
Wolverine	7,720.82	.....
Daugherty Ref.	933.00	534.00
Valvoline	65,597.05	57,400.61
Other companies	158,770.24	146,023.84
Total	1,999,289.11	1,627,928.71
Daily average	64,493.19	58,140.31

Petroleum Deliveries

The following tables exhibit the shipments or regular deliveries of various pipe lines in New York, Pennsylvania, West Virginia, Ohio, Kentucky and Indiana for January and February:

	Jan., 1933	Feb., 1933
Nat. Transit	540,616.88	525,991.40
S. W. Pa. P. L.	412,622.32	321,153.15
Eureka P. L.	294,817.80	119,265.69
Buckeye P. L. (Macksburg)	301,526.13	256,855.10
Buckeye P. L. (Cleveland)	1,461.72	1,462.52
Buckeye P. L. (Lima, etc.)	1,386,405.35	1,388,854.57
Indiana P. L.	983,543.81	898,950.00
Bradford Trans.	444,520.05	303,580.32
Southern P. L.	48,139.32	.....
Tuscarora	245,510.59	191,325.21
N. Y. Transit	186,221.84	177,999.97
Northern P. L.	179,691.14	3,208.87
Tide Water P. L.	454,238.61	423,538.54
Pure Oil	535,956.25	455,417.39
Valvoline Pipe	41,283.50	23,506.17
Other companies	154,205.16	140,323.13
Total	6,168,884.67	5,262,002.03
Daily average	198,996.25	187,928.64

Gross Stocks

The gross stocks held by various pipe lines in the oil producing sections of New York, Pennsylvania, West Virginia, Ohio, Indiana and Kentucky at the close of January and February:

	Jan., 1933	Feb., 1933
Nat. Transit	606,963.33	561,400.64
S. W. Pa. P. L.	317,495.45	323,362.67
Eureka P. L.	1,003,236.10	1,042,465.15
Buckeye P. L. (Macksburg)	280,624.72	267,680.02
Buckeye P. L. (Cleveland)	46,043.03	35,554.35
Buckeye P. L. (Lima, etc.)	2,466,700.56	2,321,978.33
Indiana P. L.	436,146.50	470,609.19
Bradford Trans.	253,310.49	305,235.11
Southern P. L.	158,404.30	187,628.35
Tuscarora	9,272.96	9,501.05
N. Y. Transit	94,205.81	83,683.97
Northern P. L.	232,037.46	212,109.04
Tide Water P. L.	1,045,059.40	979,708.23
Pure Oil	345,291.78	310,823.06
Valvoline Pipe	92,799.10	115,493.09
Other companies	178,918.35	185,504.94
Total	7,611,510.36	7,302,746.69
Increase	472,090.18	..
Decrease	.....	308,763.67

Grades of Oil

The following table shows the amount of the different grades of oil held by the Eastern pipe lines at the close of January and February showing gross stocks of the above fields:

	Jan., 1933	Feb., 1933
Pennsylvania	3,244,600.69	3,152,019.68
Lima	444,741.27	419,548.30
Kentucky	.....	121.80
Mid-Continent	3,921,336.53	3,584,082.60
Illinois	1,834.12	5,077.72
Michigan	288,997.70	141,356.59
Total	7,611,510.36	7,302,746.69

Daily Average Runs

The following table shows the daily average runs of the Pennsylvania, Lima and Kentucky oil fields for the past four years:

	1930	1931	1932	1933
January	75,907	53,939	53,501	64,493
February	79,256	55,163	55,495	58,140
March	76,688	54,331	57,199	.....
April	84,536	54,914	57,348	.....
May	70,546	53,344	59,105	.....
June	75,430	54,110	64,371	.....
July	68,921	50,723	63,402	.....
August	64,291	51,503	67,676	.....
September	56,595	61,345	65,423	.....
October	58,179	65,595	65,960	.....
November	52,352	59,819	60,602	.....
December	53,999	61,835	57,401	.....

Daily Average Shipments

The following table gives daily average shipments from the Pennsylvania, Lima and other fields for the past four year:

	1930	1931	1932	1933
January	217,623	175,269	186,551	198,996
February	224,355	182,494	169,856	187,928
March	228,846	189,508	188,793	.....
April	241,845	191,450	202,036	.....
May	248,333	199,347	201,404	.....
June	254,401	221,156	201,633	.....
July	207,094	211,632	202,859	.....
August	205,506	224,166	187,829	.....
September	193,999	217,537	170,524	.....
October	157,675	210,821	188,504	.....
November	146,638	196,426	189,626	.....
December	143,001	176,241	186,135	.....

Gross Stocks

In the following table will be found the gross stocks of the various lines of the Pennsylvania, Lima and Kentucky oil fields, including oil received from other lines at the close of each month for the past three years:

	1931	1932	1933
January	11,331,093	9,023,914	7,608,270
February	11,506,489	8,974,350	7,302,746
March	11,013,163	8,802,152	.....
April	11,044,481	8,908,461	.....
May	10,728,230	8,835,734	.....
June	9,903,349	8,732,724	.....
July	9,569,849	8,176,956	.....
August	9,192,457	8,128,576	.....
September	8,492,481	7,895,431	.....
October	8,417,594	7,421,630	.....
November	8,830,386	7,116,200	.....
December	9,119,032	7,139,420	.....

The Illinois Field

The following table gives the report of the Illinois Pipe Line Co. in Illinois:

Gross sticks, March 1	532,677.23
Runs from wells	285,550.55
Other receipts	43,878.44
Regular deliveries	276,811.41
Other deliveries	42,581.27

The amount of Illinois oil run by the Tide Water Pipe Co. in February was 20,970.06 bbls. Deliveries were 17,528.94 bbls. Adding these figures to those of the Illinois Pipe Line Co. makes the runs and deliveries as follows:

	Runs	Deliveries
1933—		
February	306,520.61	294,340.35
1932—		
January	500,177.12	246,634.10
February	432,561.50	186,010.30
March	565,538.70	270,617.75
April	461,920.32	285,817.98
May	521,884.64	279,859.53
June	501,878.26	263,702.70
July	466,635.89	284,537.18
August	476,095.53	307,325.89
September	436,529.06	329,994.39
October	332,680.67	352,620.34
November	346,880.27	338,351.23
December	336,072.57	317,749.63
1933—		
January	344,054.34	314,108.93

Tide Water Pipe Co., Ltd., also delivered in February 92,394.32 bbls. Oklahoma oil.

Average Daily Imports of Crude and Refined Oil at Principal United States Ports

Average barrels per day in 1932-33—	ATLANTIC PORTS: Baltimore	Boston	New York	Philadelphia	Others	Total	GULF COAST PORTS: Galveston	New Orleans, Baton Rouge	Port Arthur, Sabine Pass	Tampa	Total	Total all ports
March	25,806	10,516	167,806	38,677	48,135	290,935	5,936	39,774	.....	1,516	47,226	338,161
April	37,167	18,467	158,233	38,733	39,400	292,000	6,767	44,600	2,167	3,333	54,867	346,867
May	21,161	2,065	170,226	50,774	14,935	269,161	903	710	4,194	1,516	7,323	276,484
June	30,900	11,700	199,300	22,733	29,900	294,533	.....	.....	12,867	.....	12,867	307,400
July	2,613	2,161	82,965	14,935	2,129	84,806	.....	.....	.....	.....	.....	84,806
August	3,323	2,161	72,678	25,613	2,096	105,871	.....	.....	.....	.....	.....	105,871
September	5,100	2,200	57,900	12,167	10,066	87,433	.....	.....	.....	.....	.....	87,433
October	14,033	.....	72,193	30,646	7,129	124,000	.....	.....	.....	.....	2,000	126,000
November	14,167	.....	48,967	18,233	8,900	92,267	.....	.....	.....	.....	2,133	94,400
December	14,258	2,065	84,323	28,162	9,256	138,064	.....	.....	.....	.....	5,226	143,290
January	7,644	4,355	64,194	25,710	6,613	108,516	.....	.....	.....	.....	548	109,064
February	7,682	4,789	120,490	12,610	10,822	156,393	.....	.....	.....	.....	2,357	158,750

Average Daily Receipts of California Crude and Refined Oil at Atlantic and Gulf Ports

Average barrels per day in 1932-33—	ATLANTIC PORTS: Baltimore	Boston	New York	Philadelphia	Others	Total	GULF COAST PORTS: Galveston	New Orleans, Baton Rouge	Port Arthur, Sabine Pass	Tampa	Total	Total all ports
March	1,516	.....	6,065	.....	.....	7,581	.....	.....	.....	.....	.....	7,581
April	3,530	.....	15,335	3,867	4,833	31,533	.....	.....	.....	.....	.....	31,533
May	2,161	.....	15,226	13,774	3,871	40,032	.....	.....	.....	.....	.....	40,032
June	3,500	.....	17,333	3,933	833	24,600	.....	.....	.....	.....	.....	24,600
July	3,323	.....	22,226	8,677	8,935	43,161	.....	.....	.....	.....	.....	43,161
August	4,452	.....	22,484	7,548	7,677	42,161	.....	.....	.....	.....	.....	42,161
September	2,906	.....	5,000	11,633	7,967	27,500	.....	.....	.....	.....	.....	27,500
October	3,387	1,226	14,452	9,355	9,193	36,613	.....	.....	.....	.....	.....	36,613
November	4,667	.....	21,700	7,767	2,366	36,500	.....	.....	.....	.....	.....	36,500
December	4,129	.....	15,678	5,322	8,226	33,355	.....	.....	.....	.....	4,903	38,258
January	948	1,484	20,903	3,742	18,064	45,161	.....	.....	.....	.....	.....	45,161
February	8,106	1,643	14,250	10,965	11,500	47,464	.....	.....	.....	.....	2,643	50,107

Gross Production of Crude Oil in the United States for 12 Months

(In barrels of 42 gallons)

1932-33—		California	Oklahoma	Texas	Kansas	Arkansas	Louisiana	Rocky Mts.	Eastern	Total
February:	Month	14,616,862	11,896,190	23,858,275	2,835,839	1,008,563	1,617,087	2,430,224	3,374,500	61,540,140
	Daily average	504,030	407,110	832,703	97,891	34,778	55,762	83,456	116,345	2,122,074
March:	Month	15,576,915	13,998,796	26,162,647	3,042,929	1,062,897	1,703,144	2,617,392	3,643,900	66,806,720
	Daily average	502,449	419,316	813,956	98,159	34,287	54,942	84,433	117,516	2,155,055
April:	Month	15,524,444	12,718,020	24,362,851	2,974,080	1,048,020	1,858,957	2,526,040	3,766,500	66,778,012
	Daily average	517,481	423,934	878,762	99,136	34,954	61,965	84,168	125,532	2,225,934
May:	Month	15,576,741	13,149,430	27,228,472	3,028,980	1,064,602	2,012,701	2,600,682	3,891,000	68,681,549
	Daily average	502,442	424,820	881,564	98,030	34,343	64,926	83,893	125,516	2,215,554
June:	Month	14,118,970	12,757,320	26,161,092	2,837,179	1,022,970	1,857,433	2,416,680	3,577,000	64,748,554
	Daily average	470,632	425,241	872,036	94,573	34,099	61,914	80,556	119,233	2,158,285
July:	Month	14,637,550	13,030,571	26,946,714	2,906,568	1,060,336	1,933,757	2,554,648	3,723,000	66,793,434
	Daily average	471,856	420,341	869,248	93,760	34,204	62,379	82,408	120,097	2,154,304
August:	Month	14,839,951	12,743,566	26,924,963	3,046,959	1,062,297	1,870,764	2,413,526	3,873,000	66,775,726
	Daily average	478,708	411,086	868,547	98,289	34,267	60,347	77,856	124,935	2,154,056
September:	Month	14,351,140	11,795,240	27,366,515	2,970,750	1,019,250	1,929,161	2,289,200	3,615,000	65,349,396
	Daily average	478,371	393,174	912,217	99,024	33,975	64,305	76,310	120,500	2,174,980
October:	Month	14,627,663	11,915,811	27,213,833	2,892,486	1,019,321	1,963,063	2,354,444	3,814,000	65,701,230
	Daily average	471,860	384,381	877,866	93,306	32,901	63,325	75,734	123,032	2,119,394
November:	Month	14,142,389	11,340,020	26,156,653	2,841,780	1,020,600	1,962,943	2,169,685	3,578,000	63,211,979
	Daily average	471,413	378,021	871,855	94,736	34,020	65,431	72,323	119,267	2,107,066
December:	Month	14,596,028	11,637,171	25,487,818	2,777,379	1,037,539	1,966,481	2,067,855	3,694,000	61,263,770
	Daily average	470,807	375,393	767,672	89,609	33,469	63,435	66,705	119,161	1,976,351
January:	Month	14,460,282	12,483,111	26,035,549	2,871,282	943,020	1,984,413	2,237,722	3,112,000	64,117,379
	Daily average	466,461	402,681	839,856	92,622	30,420	64,013	71,862	100,387	2,068,302
Total 12 months		177,055,935	148,306,196	314,904,470	35,039,901	12,371,274	22,659,904	28,557,209	43,663,000	781,657,889

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Tulsa, Oklahoma.

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THE OIL AND GAS JOURNAL
Tulsa, Oklahoma.

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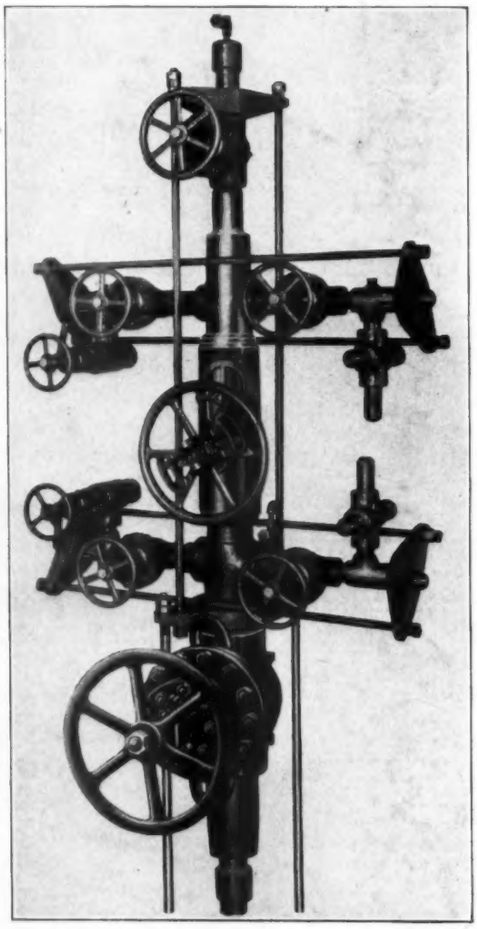

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